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INVENTOR : MOGI SATOSHI;

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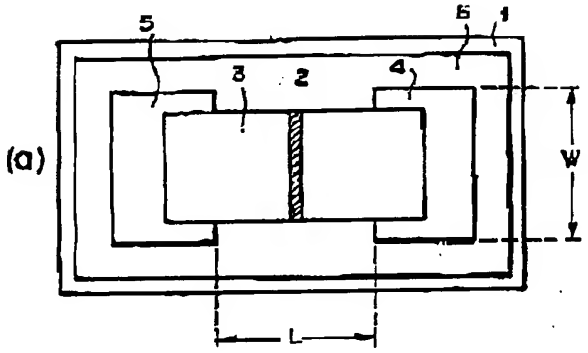
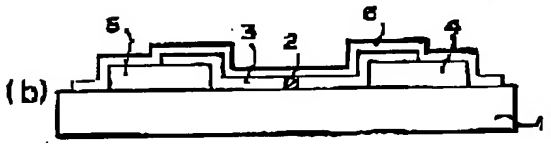
TITLE : ELECTRON EMITTING ELEMENT AND ITS MANUFACTURE





ABSTRACT : PROBLEM TO BE SOLVED: To extremely stabilize electron emitting characteristics and to prevent deterioration of an element by discharge by forming a carbonaceous thin film on the insulating base of a surface conductive electron emitting element.

SOLUTION: The sheet resistance of a conductive thin film 3 is limited to a resistance capable of forming a satisfactory electron emitting part in the forming process of an electron emitting part 2. After the electron emitting part 2 is formed, it is preferred to sufficiently apply the voltage to the electron emitting part 2, and the resistance of the conductive thin film 3 is preferably lower. Namely, the conductive thin film 3 is formed as a metal oxide semiconductor thin film having a resistance of 10^3 Ω/(square) or more and 10^7 Ω/(square) or less, and used as a metal film with lower resistance by performing a reduction after forming. On the other hand, a carbonaceous thin film 6 consists of a carbonaceous thin film mainly composed of carbon, which has a conductivity of 10^4 Ω/(square)-10^{10} Ω/(square). The element current is preferably as small as possible, and the resistance is preferably set to 10^8 Ω/(square). The carbonaceous thin film 6 is made amorphous or crystallized.

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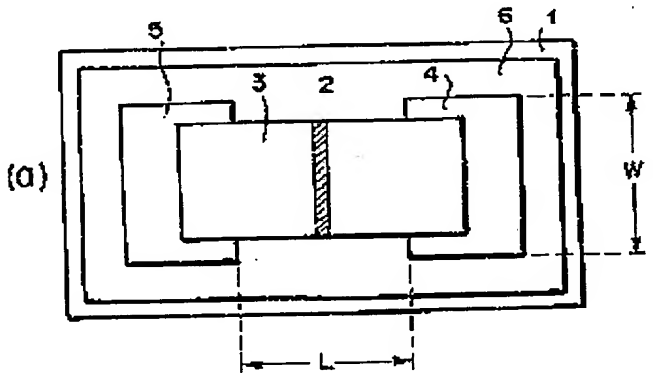
(54)【発明の名称】　電子放出素子及びその製造方法

(57)【要約】

【課題】　表面伝導型電子放出素子に対し、その帯電を防止でき、かつリーク電流が実質上問題にならないほど小さい被膜を形成し、かつ、２次電子放出係数の少ない材料の被膜の膜厚、抵抗値を精度良くコントロールした状態で均一に形成できる技術を提供する。

【解決手段】表面伝導型電子放出素子の絶縁性基体１上に炭素系薄膜６を形成する。具体的には、炭素系薄膜６の導電率を１０^{7}Ω／□から１０^{10}Ω／□としている。又、前記炭素系薄膜６をアモルファス化させるか、又は結晶化させている。



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【特許請求の範囲】
【請求項１】　絶縁性基板上に形成され、対向する一対の素子電極と電子放出部を含む導電性薄膜とを有する電子放出素子であって、
前記電子放出素子に対向する位置にアノードを配し、
前記電子放出素子の表面又は裏面に炭素系薄膜を形成することを特徴とする電子放出素子。
【請求項2】　前記電子放出素子は表面伝導型電子放出素子であることを特徴とする請求項1記載の電子放出素子。
【請求項３】　前記炭素系薄膜の導電率が１０$^{-}$ Ω/□から１０^{7}Ω/□であることを特徴とする請求項１又は２記載の電子放出素子。
【請求項４】　前記炭素系薄膜をアモルファス化．又は結晶化させることを特徴とする請求項１又は2記載の電子放出素子。
【請求項５】　請求項１乃至４のいずれか記載の炭素系薄膜を有する電子放出素子を、前記基板上に複数個設けた電子源を備えた画像形成層値であって、
前記電子源は．真空中に設置され、
前記真空を保持する支持体の表面に前記炭素系薄膜を形成することを特徴とする画像形成装置。
【請求項６】　炭素系薄膜を具備し．絶縁性基板上に形成された対向する一対の素子電極と．電子放出部を含む導電性薄膜とを有する電子放出素子の製造方法であって、
前記炭素系薄膜は、有機分子中で電子放出させ．電子線直合させることにより形成することを特徴とする電子放出素子の製造方法。
【請求項７】　炭素系薄膜を具備し．絶縁性基板上に形成された対向する一対の素子電極と電子放出部を含む導電性薄膜とを有する電子放出素子の製造方法であって、
前記炭素系薄膜は、絶縁性材料に鳥鉛状微結晶を分散させた溶液を塗布することにより形成することを特徴とする電子放出素子の製造方法。
【発明の詳細な説明】
【０００１】
【発明の属する技術分野】本発明は．電子放出素子およびその製造方法に関し、特に、電子放出素子の放電を抑制するための表面処理に関する。
【０００２】
【従来の技術】従来、電子放出素子としては大別して熱

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num cones", J.Appl.Phys., ４７, ５２４８（１９７６）等に開示されたものが知られている。
【０００３】ＭＩＭ型の例としてはC.A.Mead, "Operation of Tunnel-Emission Devices", J.Apply.Phys, ３２, ６４６（１９６１）等に開示されたものが知られている。
【０００４】表面伝導型電子放出素子型の例としては、M.I.Elinson,Radio Eng.Electron Phys., １０, １２９０（１９６５）等に開示されたものがある。
【０００５】表面伝導型電子放出素子は、基板上に形成された小面積の薄膜に、膜面に平行に電流を流すことにより．電子放出が生ずる現象を利用するものである。この表面伝導型電子放出素子としては．前記エリンソン等によるＳｎＯ２ 薄膜を用いたもの、Ａｕ薄膜によるもの［G.Dittmer: "Thin Solid Films", ９, ３１７（１９７２）］、Ｉｎ２ Ｏ３ ／ＳｎＯ２ 薄膜によるもの［M.Hartwell and C.G.Fonstad: "IEEE Trans.ED Conf.", ５１９（１９７５）］．カーボン薄膜によるもの［荒木久　他：真空、第２６巻、第１号、２２頁（１９８３）］等が報告されている。
【０００６】これらの表面伝導型電子放出素子の典型的な例として前述のM．ハートウェルの素子構成を図２１に模式的に示す。同図において１は基板である。４は導電性薄膜で、Ｈ型形状のパターンに．スパッタで形成された金属酸化物薄膜等からなり、後述の通電フォーミングと呼ばれる通電処理により電子放出部５が形成される。尚．図中の素子電極間隔Ｌは、０．５～１ｍｍ．Ｗ[illegible]は．０．１ｍｍで設定されている。
【０００７】従来、これらの表面伝導型電子放出素子においては、電子放出を行う前に導電性薄膜４を予め通電フォーミングと呼ばれる通電処理によって電子放出部５を形成するのが一般的であった。即ち．通電フォーミングとは前記導電性薄膜４両端に直流電圧あるいは非常にゆっくりとした昇電圧、例えば１Ｖ／分程度を印加通電し．導電性薄膜を局所的に破壊、変形もしくは変質せしめ．電気的に高抵抗な状態にした電子放出部５を形成することである。尚、電子放出部５は導電性薄膜４の一部に亀裂が発生しその亀裂付近から電子放出が行われる。前記通電フォーミング処理をした表面伝導型電子放出素子は．上述導電性薄膜４に電圧を印加し、素子に電流を流すことにより．上述電子放出部５より電子を放出せしめるものである。
【０００８】上述の表面伝導型電子放出素子は、構造が単

した行を多数行配列した電子源があげられる（例えば、特開昭６４－０３１９３２号公報、特開平１－２８３７４９号公報、２－２５７５５２号公報等）。

【０００９】また、特に表示装置等の画像形成装置においては、近年、液晶を用いた平板型示装置が、ＣＲＴに替わって、普及してきたが、自発光型でないため、バックライトを持たなければならない等の問題点があり、自発光型の表示装置の開発が、望まれてきた。自発光型表示装置としては、表面伝導型放出素子を多数配置した電子源と電子源より放出された電子によって、可視光を発光せしめる蛍光体とを組み合わせた表示装置である画像形成装置が、あげられる（例えば、ＵＳＰ５，０６６，８８３）。

【００１０】

【発明が解決しようとする課題】しかしながら、薄型画像形成装置においては、上記電子放出素子は、蛍光体に加速された電子線を入射させて輝度を得る。これらの電子放出素子は真空中で取り扱われる。真空中での電子放出特性の不安定性の一要因として、電子放出部近傍に絶縁性基板表面が露出していると、その表面の電位が不安定となるため電子放出が不安定となることが、本出願人による特開平０２－０７２５３４号公報で述べられている。

【００１１】入力信号に応じて応答する画像形成装置においては、各電子放出素子を電気的に分離する必要があるので、絶縁性の基板が通常用いられる。しかし、画像表示部における蛍光体に高圧をかけると、対向する電子放出素子の周りの絶縁面は真空と絶縁体の誘電率できまる容量分割による電位が発生する。この電位は絶縁性が良好であればあるほど時定数が長く、帯電したままである。

【００１２】更に、この状態で電子放出素子から電子を放出すると、電子は帯電した絶縁面にも衝突する。電子が加速されることより、上記絶縁性基板表面に電子、イオン等の荷電粒子が注入されると２次電子が発生する。特に高電界下では異常放電に至るため素子の電子放出特性が著しく低下し、最悪の場合、素子が破壊することが実験的に確かめられている。この異常放電現象については未だ不明な点があるが、素子から放出された電子、イオン等の注入により表面の帯電、あるいは帯電した絶縁性面で２次電子放出より雪崩的に電子増倍され、放電することが考えられる。

放出される電流（以降電子放出電流Ｉｅと呼ぶ）との電流比をさす。

【００１４】つまり、素子電流はできるだけ小さく、放出電流はできるだけ大きいことが望ましいが、上記帯電防止膜のリーク電流が素子電流に加算されるため、効率が低下する。

【００１５】さらに、電荷や電子が注入された場合に放出される２次電子は材料によって依存し、材料はこの２次電子放出係数が少ない材料を選択するのが好ましい。

【００１６】これらの問題点を解決するには、帯電を防止でき、かつリーク電流が実質上問題にならないほど小さい被膜を形成するのが好ましく、かつ、２次電子放出係数の少ない材料の被膜の膜厚、抵抗値を精度良くコントロールした状態で均一に形成できる技術が望まれている。

【００１７】以上のように電子放出特性の安定性と寿命の向上がなされれば、例えば蛍光体を画像形成部材とする画像形成装置においては、高品位な画像形成装置例えば、フラットテレビが、実現される。

【００１８】そこで、本発明は、安定性のよい表面伝導型電子放出素子の構成と製法及びそれを用いた電子源及び画像形成装置を提供することを課題としている。

【００１９】

【課題を解決するための手段】上記課題を解決するための本発明は、電子放出部周辺の絶縁性基板表面を、炭素系薄膜に被覆した電子放出素子及びその製造方法であって、詳しくは、絶縁性の基体上に形成された対向する一対の素子電極と電子放出部を含む導電性薄膜とを有する表面伝導型電子放出素子において、該表面伝導型電子放出素子の絶縁性基体上に炭素系薄膜を形成するようにしている。

【００２０】更に具体的には、炭素系薄膜の導電率を１０$^{-}$Ω／□から１０^{11}Ω／□としている。

【００２１】又、前記炭素系薄膜をアモルファス化させるか、又は結晶化させている。

【００２２】又、本発明では、表面伝導型電子放出素子を、基板上に複数個設けた電子源を用いて、入力信号に応じて、画像を形成する装置において、少なくとも蛍光体と電子源で構成された画像形成装置において、真空を保持する容器の支持体の壁面に炭素系薄膜をが形成するようにしている。

【００２３】又、本発明では、炭素系薄膜を具備する絶

出素子の製造方法において、絶縁性薄膜に島状微結晶を分散させて形成するようにしている。

【００２５】

【発明の実施の形態】以下、図面を参照して、本発明の実施形態について説明する。

【００２６】図１ａ，ｂは、それぞれ、基本的な表面伝導型電子放出素子の構成を示す平面図及び断面図である。図１を参照して、本発明に係る素子の基本的な構成を説明する。図１において１は基板、４と５は素子電極、３は電子放出部を含む薄膜、２は電子放出部、６は炭素系薄膜である。ここで電子放出部を含む薄膜３は、１０７ Ω／□以下のシート抵抗値を示すのが好ましい。この電子放出部を含む薄膜３のシート抵抗値は、後述する電子放出部２の形成工程、すなわちフォーミング工程において、良好な電子放出部の形成できる抵抗値として制限される。良好な電子放出部を形成するには、１０^{2} Ω／□以上１０^{7} Ω／□以下抵抗値であることが好ましい。しかしながら、電子放出部２を形成した後は、素子電極を通じて印加される電圧が十分に電子放出部２に印加されるのが好ましく、電子放出部を含む薄膜３の抵抗値はより低いほうが好ましい。このため、詳しくは後述するが、電子放出部を含む薄膜３は１０^{7} Ω／□以上１０^{2} Ω／□以下の抵抗値を持つ金属酸化膜半導体薄膜として形成し、フォーミング後に還元して、より低抵抗な金属薄膜として用いることができる。したがって、最終的な状の電子放出部を含む薄膜３の抵抗値の下限は特に限定されない。なお、ここで言う電子放出部を含む薄膜３の抵抗値とは、電子放出部２を含まない領域で測定される抵抗値を意味している。

【００２７】一方、炭素系薄膜６は炭素を主成分とする炭素系薄膜であり、１０^{3} Ω／□～１０^{11} Ω／□の抵抗であるのが望ましい。これは、後述するように、素子の電子出特性において、素子電流はできるかぎり小さいほうが好ましく、そのため炭系薄膜６の抵抗値は１０^{3} Ω／□であるのが好ましい。また、炭素系薄膜６が分な２次電子放出系数を有するためには１０^{11} Ω／□以下の比抵抗値であるのが好ましい。

【００２８】なお、図8は、本発明に係る垂直型の表面伝導型電子放出素子を示す図であり、電子放出部2が基板1に垂直に形成されている点を除いて、図1の電子放出素子と同様である。

【００２９】次に、図２を参照して、順を追って製造方法

れるものが好ましく、後述するように炭素材料が好適に用いることができる。なお、この工程は、電子放出部形成用薄膜３の形成の前に行ってもよい。一般に、薄膜は島状な組織になりやすく、所望のシート抵抗値を得るためには、連続でかつ一様な薄膜が好ましい。この点で炭素薄膜は、好都合である。炭素薄膜は膜厚が１ｎｍ以上あれば、連続膜で一様になることが実験的に確かめられている。さらに炭素は２次電子放出係数も小さいことが知られている。炭素薄膜の形成方法としては、スパッタ法、真空蒸着法、塗布法、炭素系ガスによる電子ビームによる重合法、あるいはプラズマ法、ＣＶＤ法等があげられる。これらのどの方法によっても、安定した炭素薄膜が容易に得られる。なお、詳細な成膜については、実施例で述べる。

【００３３】次に、フォーミングにより、電子放出部２を形成し、活性化処理をおこなう（図２（ｄ））。

【００３４】以上、本発明の電子放出素子の製造方法について説明した。

【００３５】なお、本発明における炭素系薄膜６の形成によって、電子放出素子の基本的な特性は左右されない。これは、炭素系薄膜６の抵抗値が十分に高いため（１０^{8}Ω／□以上）、炭素系薄膜６を通って流れるリーク電流が、電子放出を行っているときに観測される素子電流に比べて、十分小さいためである。

【００３６】又、本実施形態に従えば、絶縁性基板表面の帯電が防止されるかつ帯電しても２次電子放出係数が小さいために電子増倍による雪崩的な異常放電を抑制することができる。このため、絶縁性表面の電位不安定性に起因した電子放出特性の不安定性や、素子近傍とアノード間での放電が抑制されるために、長時間の安定な電子放出特性が得られる。

【００３７】以上のように本発明に係る電子放出素子は、長時間にわたって安定な電子放出特性、即ち、素子電流Ｉｆ、放出電流Ｉｅの素子印加電圧に対する単調増加特性を有するため、多方面への応用が期待できる。

【００３８】以上、表面伝導型電子放出素子の基本的な構成、製法について述べたが、本発明の思想によれば、表面伝導型電子放出素子の特性で３つの特徴を有すれば、上述の構成等に限定されず、後述の電子源、表示装置等の画像形成装置に於ても適用できる。

【００３９】

【実施例】（実施例１）本発明に係る基本的な表面伝導

に、素子電極４、５と素子電極間ギャップＧとなるべきパターンをホトレジスト（ＲＤ－２０００Ｎ－４１　日立化成社製）形成し、真空蒸着法により、厚さ５０オングストロームのＴｉ、厚さ１０００オングストロームのＰｔを順次堆積した。ホトレジストパターンを有機溶剤で溶解し、Ｐｔ／Ｔｉ堆積膜をリフトオフし、素子電極間隔Ｌ１は１０ミクロンとし、素子電極の幅Ｗ１を３００ミクロン、を有する素子電極４，５を形成した。

（工程－ｂ）本工程に係る電子放出素子の電子放出部形成用薄膜３のマスクは、素子間電極ギャップＬ１およびこの近傍に開口を有するマスクであり、このマスクにより膜厚１０ｎｍのＣｒ膜を真空蒸着により堆積・パターニングし、そのうえに有機Ｐｄ（ｃｃｐ４２３０奥野製薬（株）社製）をスピンナーにより回転塗布、３００℃で１２分間の加熱焼成処理をした。また、こうして形成された主元素としてＰｄよりなる微粒子からなる電子放出部形成用薄膜４の膜厚は１００オングストローム、シート抵抗値は2×10^4Ω／□であった。なおここで述べる微粒子膜とは、上述したように、複数の微粒子が集合した膜であり、その微細構造として、微粒子が個々に分散配置した状態のみならず、微粒子が互いに隣接、あるいは、重なり合った状態（島状も含む）の膜をさし、その粒径とは、前記状態で粒子形状が認識可能な微粒子についての径をいう。

（工程－ｃ）Ｃｒ膜および焼成後の電子放出部形成用薄膜３を酸エッチャントによりエッチングして所望のパターンを形成した。

【００４１】以上の工程により基板１上に、素子電極４、５、電子放出部形成用薄膜３等を形成した。

（工程－ｄ）素子電極４、５及び電子放出部形成用薄膜３を形成した基板１を再度洗浄し、乾燥させた後、以下に述べる方法により、基板１の表面全体を炭素系薄膜６で被覆した。

【００４２】炭素薄膜は、ＲＦマグネトロンスパッタによって形成した。使用したターゲットはＣ（純度９９．９９％）である。使用したガスはＡｒで、Ａｒ分圧５ｍＴｏｒｒで、スパッタパワーは５Ｗ／□である。なお、膜厚はスパッタ時間でコントローする。

【００４３】そして、上述と同様に、炭素薄膜をガラス基板上に、それぞれ１ｎｍ、２ｎｍ、３ｎｍ、５ｎｍ、１０ｎｍ、２０ｎｍ成膜し、Ｃの薄膜を得た。各層数の基板のシート抵抗を４探針法により測定したところ、膜[illegible]

【００４４】又、炭素系薄膜の帯電の様子を評価するために、図３に示す評価回路をいた。１は絶縁体の基板で、２０は絶縁体基板の裏面からグランドをとるための電極、３０は電極でグランドに接地してある。６は炭素系薄膜である。８０は帯電の様子を見るためのプローブ電極で、この電位は、表面電位計９０に接続してある。５０はアノード電極で高圧電源７０と接続してある。このような測定系は基板およびアノード電極は真空容器内にあり、真空中で測定される。

【００４５】この結果を図４を参照して説明する。ある時刻に高圧電源６からアノード電圧Ｖａを印加すると、炭素系薄膜４がない場合、つまり絶縁性基板のみの場合、プローブ電極の電位は、真空と絶縁基板の誘電率と空間の距離できまる容量で分割され正の電位に帯電する。絶縁性が高ければ高いほどこの正の電位は長く保存される。また、アノード電圧Ｖａをオフにすると負の電位に帯電する。

【００４６】たとえば、Ｖａを５ＫＶ程度印加するとプローブ電位は２ＫＶ以上増加することがあり、この場合、接地してある電極３とプローブ電極間８に高い電圧がかかり、その結果絶縁破壊し放電することがある。

【００４７】一方、絶縁性基板上に炭素系薄膜を形成すると図４のように電位が、ある時定数で減衰する。この時定数は、同じ構成、つまり容量が同じだとすると炭素系薄膜の抵抗できまる時定数で減衰し、電位が０Ｖになる。電位が０Ｖであれば、各電極とに高い電位差を生じないので絶縁破壊することがない。

【００４８】この測定をもとに上述の炭素系薄膜の膜厚を１ｎｍ－２０ｎｍにしたときの帯電の様子を計測した。この結果、どの膜厚においても帯電は、すぐに減衰することが分かった。ちなみに１ｎｍのときの減衰時間は１０ｍｓ程度であった。また、どの膜厚においても、薄膜の構造は連続膜であり、電気的にも接続が良好であった。

【００４９】実験的に炭素系薄膜の導電率が10^4Ω／□から10^{12}Ω／□程度であれば、減衰時間は１ｓ以下であり、高圧を２０ＫＶ程度あけても絶縁破壊することがないことが判明した。

【００５０】上述の検討により、炭素系薄膜の膜厚は１ｎｍ程度にした。

（工程－ｅ）次に、図２に図示しない工程－ｅにおいては、図６に示す測定評価装置に設置し、真空ポンプにて[illegible]

のピーク電圧）は０．１Ｖステップで昇圧し、フォーミング処理を行った。また．フォーミング処理中は．同時に．０．１Ｖの電圧で、Ｔ２間に抵抗測定パルスを挿し．抵抗を測定した。尚フォーミング処理の終了は、抵抗測定パルスでの測定値が．約１Ｍオーム以上になった時とし、同時に．素子への電圧の印加を終了した。このときのフォーミング電圧ＶＦは、５．０Ｖであった。

【００５２】この後、素子を真空中に保持したまま、１５０℃でアニーリングし．電子放出部を含む薄膜３と炭素薄膜６を同時に還元した。

（工程－ｆ）続いて、図2に図示しない工程-fにおいては．アセトンをアンプルに封じたものをスローリークバルブを通して真空内に導入し、１．０×１０⁻⁵Torrを維持した。

【００５３】次にフォーミング処理した素子に．図５に示す三角波を矩形波に変え．その波高値を１４Ｖとして．活性化処理をした。

【００５４】活性化処理においては．図６に示す測定評価装置内で、素子電極間には、素子電流Ｉｆ及び放出電流Ｉｅを測定しながら、パルス電圧を印加した。効率η（Ｉｅ／Ｉｆｘ１００％）が、約３０分で最大になったため．通電を停止し、スローリークバルブを閉め．活性化処理を終了した。

（工程－ｇ）こうして、図2に図示しない工程－gにおいては、電子放出部2を形成し電子放出素子８４を作製し．電子放出特性を評価した。

【００５５】なお、アノード電極と電子放出素子間の距離を４ｍｍ、アノード電極の電位を５０００Ｖ．電子放出特性測定時の真空装置内の真空度を１×１０⁻⁶Torrとした。素子の電極５及び６の間に素子電圧を１４Ｖ印加したが、電子放出特性は極めて安定で．放電等による素子の破壊は生じなかった。

【００５６】なお、比較のため炭素系薄膜のないサンプルを評価したところ、電子放出量の時間的変化が大きく．また５時間以内に放電が生じ素子が破壊した。

【００５７】以上より本発明による炭素系薄膜により、安定で放電の生じない電子放出特性が得られた。

（実施例２）本実施例では．図７に示すように．炭素系薄膜を基板に最初に形成したサンプルについて述べる。

（工程－ａ）清浄化した青板ガラス１上に炭素分散材料（粒径０．１μｍ）市販のものの水溶液をスピンコートした。炭素分散材料は黒鉛を主成分として、導電率をさ

板１上に、素子電極４，５と素子電極間ギャップＧとなるべきパターンをホトレジスト（ＲＤ－２０００Ｎ－４１　日立化成社製）形成し．真空蒸着法により．厚さ５０ＡのＴｉ、厚さ１０００ＡのＰｔを順次堆積した。ホトレジストパターンを有機溶剤で溶解し、Ｐｔ／Ｔｉ堆積膜をリフトオフし、素子電極間隔Ｌ１は１０ミクロンとし．素子電極の幅Ｗ１を３００ミクロン、を有する素子電極４，５を形成した。

【００５８】そして、種々の膜厚に対する基板のシート抵抗を４探針法により測定したところ．膜厚０．１μｍのとき、８×１０⁷Ω／□．膜厚０．２μｍのとき、１×１０⁷Ω／□．膜厚０．４μｍのとき、５×１０⁶Ω／□．膜厚０．６μｍのとき、１×１０⁶Ω／□．膜厚１．０μｍのとき、２×１０⁵Ω／□．であった。なお．これらの膜厚と抵抗値の関係は．黒鉛中の不純物材料および混合比率を変えたり、スピンコート条件．水溶液濃度、熱処理条件等で変えることもでき、上記関係は普遍的なものではない。

【００５９】又．実施例１と同様に種々の膜厚に対する電位測定を行った。この場合もどの膜厚においても時定数１０ｍｓ以下で電位は減衰し、０Ｖであることがわかった。

【００６０】又．作製した炭素系薄膜の結晶性を評価するために、Ｘ線回折ならびにラマン分光をおこなった。その結果、０．４μｍ以下では、アモルファス．０．４μｍ以上の範囲では、アモルファスと結晶の混合であることが判明した。

【００６１】更に、上記各膜厚炭素系薄膜の基板上に電子線照射を行い．その２次電子放出係数を計測した。電子線を５ｋＶで入射したとき２次電子放出係数は０．２μｍ以上の膜厚においては１以下であった。

【００６２】０．１μｍのとき２次電子放出係数は２以上になり、下地基板の特性に反映する帯電現象が観察された。

【００６３】以上の二つの検討により本実施例では０．４μｍの膜厚を持つ炭素系薄膜を用いた。

【００６４】さらに、本実施例では．第一の実施例に記載の工程－ｅ．工程－ｆ．工程－ｇと同様の工程で、電子放出素子を作製した。この電子放出素子において、アノード電極と電子放出素子間の距離を２．８ｍｍ．アノード電極の電位を６０００Ｖ、電子放出特性測定時の真空装置内の真空度を１×１０⁻⁶Torrとし、素子の電極及

安定で放電の生じない電子放出特性が得られた。また、同時に本発明による帯電防止膜は、アモルファスもしくは、結晶性でもよいことが判明した。

（実施例３）本実施例は、多数の表面伝導電子放出素子を単純マトリクス配置した画像形成装置の例である。

【００６７】電子源の一部の平面図を図１２に示す。また、図中のＡ－Ａ′断面図を図１３に示す。但し図１２、図１３で、同じ記号を示したものは、同じものを示す。ここで１は基板、８２は図９のＤｘｎに対応するＸ方向配線（下配線とも呼ぶ）、８３は図９のＤｙｎに対応するＹ方向配線（上配線とも呼ぶ）、３は電子放出部を含む薄膜、４、５は素子電極、６は帯電防止膜、１３１は層間絶縁層、１５２は、素子電極４，５と下配線８２との電気的接続のためのコンタクトホールである。

【００６８】次に製造方法を、図14及び図15を参照して、工程順に従って具体的に説明する。

（工程－ａ）清浄化した青板ガラス上に厚さ０．５ミクロンのシリコン酸化膜をスパッタ法で形成した基板１上に、真空蒸着により厚さ５０ＡのＣｒ、厚さ６０００ＡのＡｕを順次積層した後、ホトレジスト（Ａ２１３７０ヘキスト社製）をスピンナーにより回転塗布、ベークした後、ホトマスク像を露光、現像して、下配線８２のレジストパターンを形成し、Ａｕ／Ｃｒ堆積膜をウエットエッチングして、所望の形状の下配線８２を形成する。

（工程－ｂ）次に厚さ１．０ミクロンのシリコン酸化膜からなる層間絶縁層１５１をＲＦスパッタ法により堆積する。

（工程－ｃ）工程ｂで堆積したシリコン酸化膜にコンタクトホール１５２を形成するためのホトレジストパターンを作り、これをマスクとして層間絶縁層１５１をエッチングしてコンタクトホール１５２を形成する。エッチングはＣＦ４とＨ２ガスを用いたＲＩＥ（Reactive Ion Etching）法によった。

（工程－ｄ）その後、素子電極４、５と素子電極間ギャップＧとなるべきパターンをホトレジスト（ＲＤ－２０００Ｎ－４１　日立化成社製）形成し、真空蒸着法により、厚さ５０オングストロームのＴｉ、厚さ１０００オングストロームのＮｉを順次堆積した。ホトレジストパターンを有機溶剤で溶解し、Ｎｉ／Ｔｉ堆積膜をリフトオフし、素子電極間隔Ｌ１は３ミクロンとし、素子電極の幅Ｗ１を３００ミクロン、を有する素子電極４、５を形成した。

（工程－ｅ）素子電極４、５の上に印刷

膜厚１０００オングストロームのＣｒ膜１４１を真空蒸着により堆積・パターニングし、そのうえに有機Ｐｄ（ｃｃｐ４２３０奥野製薬（株）社製）をスピンナーにより回転塗布、３００℃で１０分間の加熱焼成処理をした。また、こうして形成された主元素としてＰｄよりなる微粒子からなる電子放出部形成用薄膜３の膜厚は１００オングストローム、シート抵抗値は５×１０⁴Ω／□であった。なおここで述べる微粒子膜とは、上述したように、複数の微粒子が集合した膜であり、その微細構造として、微粒子が個々に分散配置した状態のみならず、微粒子が互いに隣接、あるいは、重なり合った状態（島状も含む）の膜をさし、その粒径とは、前記状態で粒子形状が認識可能な微粒子についての径をいう。

（工程－ｇ）Ｃｒ膜１４１および焼成後の電子放出部形成用薄膜３を酸エッチャントによりエッチングして所望のパターンを形成した。

（工程－ｈ）コンタクトホール１５２部分以外にレジストを塗布するようなパターンを形成し、真空蒸着により厚さ５０オングストロームのＴｉ、厚さ５０００オングストロームのＡｕを順次堆積した。リフトオフにより不要の部分を除去することにより、コンタクトホール１４２を埋め込んだ。

（工程－ｉ）実施例１と同じ工程で炭素系薄膜６を形成した。

【００６９】以上の工程により絶縁性基板１上に下配線８２、層間絶縁層１４１、上配線８３、素子電極４、５、電子放出部形成用薄膜３、炭素系薄膜６等を形成した。

【００７０】なお、図８は、図２とほぼ同じ工程で作成された電子放出素子であって、電子放出部２基板１に垂直な壁面に形成したものである。ここで、図８中の絶縁性薄膜３１は、上記の垂直壁面を提供するために設けられている。

【００７１】又、基板1上に直接炭素系薄膜６を形成した図7の電子放出素子の場合も製造工程は基本的に図14，15と同じである。

【００７２】次に、以上のようにして作成した電子源を用いて表示装置を構成した例を、図９乃至図１１を参照して説明する。

【００７３】以上のようにして多数の平面型表面伝導電子放出素子を作製した基板１をリアプレート９１上に固定した後、基板１の５ｍｍ上方に、フェースプレート９

【００７４】また、リアプレート９１への基板１の固定もフリットガラスで行った。　図１０において．８４は電子放出素子．８２，８３はそれぞれＸ方向及びＹ方向の素子配線である。

【００７５】蛍光膜９４は．モノクロームの場合は蛍光体のみから成るが、本実施例では蛍光体はストライプ形状を採用し、先にブラックストライプを形成し．その間隙部に各色蛍光体を塗布し．蛍光膜９４を作製した。ブラックストライプの材料として通常良く用いられている黒鉛を主成分とする材料を用いたガラス基板９３に蛍光体を塗布する方法はスラリー法を用いた。

【００７６】また、蛍光膜９４の内面側には通常メタルバック９５が設けられる。メタルバックは、蛍光膜作製後．蛍光膜の内面側表面の平滑化処理（通常フィルミングと呼ばれる）を行い、その後、Ａｌを真空蒸着することで作製した。

【００７７】フェースプレート９６には、更に蛍光膜９４の導伝性を高めるため．蛍光膜８４の外面側に透明電極（不図示）が設けられる場合もあるが、本実施例では．メタルバックのみで十分な導伝性が得られたので省略した。

【００７８】前述の封着を行う際、カラーの場合は各色蛍光体と電子放出素子とを対応させなくてはいけないため．十分な位置合わせを行った。

【００７９】以上のようにして完成したガラス容器内の雰囲気を排気管（図示せず）を通し真空ポンプにて排気し．十分な真空度に達した後、容器外端子Ｄｘｏ１ないしＤｏｘｍとＤｏｙ１ないしＤｏｙｎを通じ電子放出素子８４の電極5．6間に電圧を印加し．電子放出部2を．電子放出部形成用薄膜２をフォーミング処理することにより作成した。フォーミング処理の電圧波形は、図５ｂと同様である。

【００８０】本実施例ではＴ１を１ミリ秒、Ｔ２を１０ミリ秒とし、約１×１０$^{-1}$Torrの真空雰囲気下で行った。

【００８１】このように作成された電子放出部2は、パラジウム元素を主成分とする微粒子が分散配置された状態となり、その微粒子の平均粒径は３０オングストロームであった。

【００８２】次にパネルの排気管よりアセトンをスローリークバルブを通してパネル内に導入し、１．０×１０$^{-1}$Torrを維持した。フォーミングと同一の矩形波で、波[illegible]

高周波加熱法でゲッター処理を行った。

【００８５】以上のように完成した本発明の画像表示装置において、各電子放出素子には、容器外端子Ｄｘ１ないしＤｘｍ，Ｄｙ１ないしＤｙｎを通じ、走査信号及び変調信号を不図示の信号発生手段よりそれぞれ．印加することにより．電子放出させ、高圧端子Ｈｖを通じ、メタルバック０９．あるいは透明電極（不図示）に数ｋＶ以上の高圧を印加し、電子ビームを加速し、蛍光膜０８に衝突させ、励起・発光させることで画像を表示した。

【００８６】この場合においても安定した画像を表示し．支持枠近傍においても．電子ビームの偏向等もおきず．放電による破壊等も見られなかった。

【００８７】なお、図16には電子放出素子をはしご型に配線した電子源を示したが、この画像表示装置の製造方法も同様である。

【００８８】図１６は、はしご型配置の電子源の一例を示す模式図である。図１６においては．電子源基板１上に．電子放出素子８４が設けられている。共通配線１２４１２（Ｄｘ１～Ｄｘ１０）は、電子放出素子８４を接続するためのものである。子放出素子８４は、基板１上に．Ｘ方向に並列に複数個配されている（これを素子行と呼ぶ）。この素子行が複数個配置されて、電子源を構成している。各素子行の共通配線間に駆動電圧を印加することで、各素子行を独立に駆動させることができる。即ち．電子ビームを放出させたい素子行には、電子放出しきい値以上の電圧を、電子ビームを放出しない素子行には．電子放出しきい値以下の電圧印加する。各素子行間の共通配線Ｄｘ２～Ｄｘ９は、例えばＤｘ２．Ｄｘ３を同一配線とすることもできる。

【００８９】図１７は、はしご型配置の電子源を備えた画像形成装置におけるパネル構造の一例を示す斜視図である。グリッド電極１３２には電子が通過するための空孔１３３が設けられている。また、Ｄ１，Ｄ２，…Ｄｍは容器外端子である。Ｇ１，Ｇ２，…Ｇｎはグリッド電極１３２に接続された容器外端子である。電子源基板１においては、各素子行間の共通配線を同一配線としている。　図１７において、基板１とフェースプレート９６の間には、グリッド電極１３２が設けられている。グリッド電極１３２は、表面伝導型放出素子から放出された電子ビームを変調するためのものであり、はしご型配置の素子行と直交して設けられたストライプ状の電極に電子ビームを通過させるため．各素子に対応して１個ずつ[illegible]

【００９１】本例の画像形成装置では、素子行を１列ずつ順次駆動（走査）していくのと同期してグリッド電極列に画像１ライン分の変調信号を同時に印加する。これにより、各電子ビームの蛍光体への照射を制御し、画像を１ラインずつ表示することができる。

【００９２】又、本発明に用いる炭素系薄膜は、電子放出素子のみならず、これを用いた画像形成装置の他の部品を被覆するにも好適である。

【００９３】図１８は、図１０に示された画像形成装置に、更に、真空支持体を設けたものである。この真空支持体２００は、フェースプレー96の平面性制を保ち、画像表示パネル111全体の強度を保つために設けられている。すなわち、電子放出を伴いつつ画像表示を行うと、その電子が、上記真空支持体200表面にチャージアップを引き起こす。かかるチャージアップを防止するためにも炭素系薄膜は有用である。

（実施例４）次に、単純マトリクス配置の電子源を用いて構成した表示パネルに、ＮＴＳＣ方式のテレビ信号に基づいたテレビジョン表示を行う為の駆動回路の構成例について、図１９を用いて説明する。図１９において、画像表示パネル１１１を駆動するため、走査回路１１２、制御回路１１３、シフトレジスタ１１４、ラインメモリ１１５、同期信号分離回路１１６、変調信号発生器１１７、直流電圧源Ｖｘおよび Ｖａが設けられている。

【００９４】表示パネル１１１は、端子Ｄｘ１乃至Ｄｘｍ、端子Ｄｙ１乃至Ｄｙｎ、及び高圧端子Ｈｖを介して外部の電気回路と接続している。端子Ｄｘ１乃至Ｄｘｍには、表示パネル内に設けられている電子源、即ち、ｍ行ｎ列の行列状にマトリクス配線された電子放出素子群を一行（ｎ素子）ずつ順次駆動する為の走査信号が印加される。

【００９５】端子Ｄｙ１乃至Ｄｙｎには、前記走査信号により選択された一行の電子放出素子の各素子の出力電子ビームを制御する為の変調信号が印加される。高圧端子Ｈｖには、直流高圧源Ｖａより、例えば１０ＫＶの直流電圧が供給されるが、これは電子放出素子から放出される電子ビームに蛍光体を励起するのに十分なエネルギーを付与する為の加速高圧である。

【００９６】走査回路１１２について説明する。同回路は、内部にｍ個のスイッチング素子を備えたもので（図中、Ｓ１乃至Ｓｍで模式的に示している）ある。各スイ

出素子の特性（電子放出しきい値電圧）に基づき走査されていない素子に印加される駆動電圧が電子放出しきい値電圧以下となるような一定電圧を出力するよう設定されている。

【００９８】制御回路１１３は、外部より入力する画像信号に基づいて適切な表示が行われるように各部の動作を整合させる機能を有する。制御回路１１３は、同期信号分離回路１１６より送られる同期信号Ｔｓｙｎｃに基づいて、各部に対してＴｓｃａｎおよびＴｓｆｔおよびＴｍｒｙの各制御信号を発生する。

【００９９】同期信号分離回路１１６は、外部から入力されるＮＴＳＣ方式のテレビ信号から同期信号成分と輝度信号成分とを分離する為の回路で、一般的な周波数分離（フィルター）回路等を用いて構成できる。同期信号分離回路１１６により分離された同期信号は、垂直同期信号と水平同期信号より成るが、ここでは説明の便宜Ｔｓｙｎｃ信号として図示した。前記テレビ信号から分離された画像の輝度信号成分は便宜上ＤＡＴＡ信号と表した。前記ＤＡＴＡ信号はシフトレジスタ１１４に入力される。

【０１００】シフトレジスタ１１４は、時系列的にシリアルに入力される前記ＤＡＴＡ信号を、画像の１ライン毎にシリアル／パラレル変換するためのもので、前記制御回路１１３より送られる制御信号Ｔｓｆｔに基づいて動作する（即ち、制御信号Ｔｓｆｔは、シフトレジスタ１０４のシフトクロックであるということもできる。）。シリアル／パラレル変換された画像１ライン分（電子放出素子Ｎ素子分の駆動データに相当）のデータは、Ｉｄ１乃至ＩｄｎのＮ個の並列信号として前記シフトレジスタ１０４より出力される。

【０１０１】ラインメモリ１１５は、画像１ライン分のデータを必要時間の間だけ記憶する為の記憶装置であり、制御回路１１３より送られる制御信号Ｔｍｒｙに従って適宜ｉｄ１乃至ｉｄｎの内容を記憶する。記憶された内容は、Ｉ′ｄ１乃至Ｉ′ｄｎとして出力され、変調信号発生器１１７に入力される。

【０１０２】変調信号発生器１０７は、画像データＩ′ｄ１乃至Ｉ′ｄｎの各々に応じて電子放出素子の各々を適切に駆動変調する為の信号源であり、その出力信号は、端子Ｄｙ１乃至Ｄｙｎを通じて表示パネル１１１内の電子放出素子に印加される。

【０１０３】前述したように、本発明を適用できる電子

る場合には電子ビームが出力される。その際、パルスの波高値Ｖｍを変化させる事により出力電子ビームの強度を制御することが可能である。また、パルスの幅Ｐｗを変化させることにより出力される電子ビームの電荷の総量を制御する事が可能である。

【０１０４】従って、入力信号に応じて、電子放出素子を変調する方式としては、電圧変調方式、パルス幅変調方式等が採用できる。電圧変調方式を実施するに際しては、変調信号発生器１１７として、一定長さの電圧パルスを発生し、入力されるデータに応じて適宜パルスの波高値を変調するような電圧変調方式の回路を用いることができる。

【０１０５】パルス幅変調方式を実施するに際しては、変調信号発生器１０７として、一定の波高値の電圧パルスを発生し、入力されるデータに応じて適宜電圧パルスの幅を変調するようなパルス幅変調方式の回路を用いることができる。

【０１０６】シフトレジスタ１１４やラインメモリ１１５は、デジタル信号式のものをもアナログ信号式のものをも採用できる。画像信号のシリアル／パラレル変換や記憶が所定の速度で行われれば良いからである。

【０１０７】デジタル信号式を用いる場合には、同期信号分離回路１１６の出力信号ＤＡＴＡをデジタル信号化する必要があるが、これには１１６の出力部にＡ／Ｄ変換器を設ければ良い。これに関連してラインメモリ１１５の出力信号がデジタル信号かアナログ信号かにより、変調信号発生器１１７に用いられる回路が若干異なったものとなる。即ち、デジタル信号を用いた電圧変調方式の場合、変調信号発生器１１７には、例えばＤ／Ａ変換回路を用い、必要に応じて増幅回路などを付加する。パルス幅変調方式の場合、変調信号発生器１１７には、例えば高速の発振器および発振器の出力する波数を計数する計数器（カウンタ）及び計数器の出力値と前記メモリの出力値を比較する比較器（コンパレータ）を組み合せた回路を用いる。必要に応じて、比較器の出力するパルス幅変調された変調信号を電子放出素子の駆動電圧にまで電圧増幅するための増幅器を付加することもできる。

【０１０８】アナログ信号を用いた電圧変調方式の場合、変調信号発生器１１７には、例えばオペアンプなどを用いた増幅回路を採用でき、必要に応じてレベルシフト回路などを付加することもできる。パルス幅変調方式の場合には、例えば、電圧制御型発振回路（ＶＣＯ）を

た電子は、蛍光膜９４に衝突し、発光が生じて画像が形成される。

【０１１０】ここで述べた画像形成装置の構成は、本発明を適用できる画像形成装置の一例であり、本発明の技術思想に基づいて種々の変形が可能である。入力信号については、ＮＴＳＣ方式を挙げたが、入力信号は、これに限られるものではなく、ＰＡＬ、ＳＥＣＡＭ方式等の他、これよりも、多数の走査線からなるＴＶ信号、例えば、ＭＵＳＥ方式をはじめとする高品位ＴＶ方式やＡＴＶ方式をも採用できる。

【０１１１】本発明の画像形成装置は、テレビジョン放送の画像形成装置（表示装置）、テレビ会議システムやコンピューター等の画像形成装置（表示装置）の他、感光性ドラム等を用いて構成された光プリンターとしての画像形成装置等としても用いることができる。

【０１１２】次に、図２０は、前記説明の表面伝導型放出素子を電子ビーム源として用いたディスプレイパネルに、たとえばテレビジョン放送をはじめとする種々の画像情報源より提供される画像情報を表示できるように構成した表示装置の一例を示すための図である。図中１８００はディスプレイパネル、１８０１はディスプレイパネルの駆動回路、１８０２はディスプレイパネルコントローラ、１８０３はマルチプレクサ、１８０４はデコーダ、１８０５は入出力インターフェース回路、１８０６はＣＰＵ、１８０７は画像生成回路、１８０８および１８０９および１８１０は画像メモリーインターフェース回路、１８１１は画像入力インターフェース回路、１８１２および１８１３はＴＶ信号受信回路、１８１４は入力部である。（なお、本表示装置は、たとえばテレビジョン信号のように映像情報と音声情報の両方を含む信号を受信する場合には、当然映像の表示と同時に音声を再生るものであるが、本発明の特徴と直接関係しない音声情報の受信、分離、再生処理、記憶などに関する回路やスピーカーなどについては説明を省略する。）以下、画像信号の流れに沿って各部の機能を説明してゆく。

【０１１３】まず、ＴＶ信号受信回路１８１３は、たとえば電波や空間光通信などのような無線伝送系を用いて伝送されるＴＶ画像信号を受信する為の回路である。受信するＴＶ信号の方式は特に限られるものではなく、たとえば、ＮＴＳＣ方式、ＰＡＬ方式、ＳＥＣＡＭ方式などの諸方式でもよい。また、これらよりさらに多数の走査線よりなるＴＶ信号（たとえばＭＵＳＥ方式をはじめ

信するＴＶ信号の方式は特に限られるものではなく、また本回路で受信されたＴＶ信号もデコーダ１８０４に出力される。

【０１１５】また、画像入力インターフェース回路１８１１は、たとえばＴＶカメラや画像読み取りスキャナーなどの画像入力装置から供給される画像信号を取り込むための回路で、取り込まれた画像信号はデコーダ１８０４に出力される。

【０１１６】また、画像メモリーインターフェース回路１８１０は、ビデオテープレコーダー（以下ＶＴＲと略す）に記憶されている画像信号を取り込むための回路で、取り込まれた画像信号はデコーダ１８０４に出力される。

【０１１７】また、画像メモリーインターフェース回路１８０９は、ビデオディスクに記憶されている画像信号を取り込むための回路で、取り込まれた画像信号はデコーダ１８０４に出力される。

【０１１８】また、画像メモリーインターフェース回路１８０８は、いわゆる静止画ディスクのように、静止画像データを記憶している装置から画像信号を取り込むための回路で、取り込まれた静止画像データはデコーダ１８０４に入力される。

【０１１９】また、入出力インターフェース回路１８０５は、本表示装置と、外部のコンピュータもしくはコンピュータネットワークもしくはプリンターなどの出力装置とを接続するための回路である。画像データや文字・図形情報の入出力を行うのはもちろんのこと、場合によっては本表示装置の備えるＣＰＵ１８０６と外部との間で制御信号や数値データの入出力などを行うことも可能である。

【０１２０】また、画像生成回路１８０７は、前記入出力インターフェース回路１８０５を介して外部から入力される画像データや文字・図形情報や、あるいはＣＰＵ１８０６より出力される画像データや文字・図形情報にもとづき表示用画像データを生成するための回路である。本回路の内部には、たとえば画像データや文字・図形情報を蓄積するための書き換え可能メモリーや、文字コードに対応する画像パターンが記憶されている読み出し専用メモリーや、画像処理を行うためのプロセッサーなどをはじめとして画像の生成に必要な回路が組み込まれている。

【０１２１】本回路により生成された表示用画像データは、デコーダ１８０４に出力されるか、[illegible]

信号を出力し、ディスプレイパネルに表示する画像信号を適宜選択したり組み合わせたりする。また、その際には表示する画像信号に応じてディスプレイパネルコントローラ１８０２に対して制御信号を発生し、画面表示周波数や走査方法（たとえばインターレースかノンインターレースか）や一画面の走査線の数など表示装置の動作を適宜制御する。

【０１２４】また、前記画像生成回路１８０７に対して画像データや文字・図形情報を直接出力したり、あるいは前記入出力インターフェース回路１８０５を介して外部のコンピュータやメモリーをアクセスして画像データや文字・図形情報を入力する。なお、ＣＰＵ１８０６は、もちろんこれ以外の目的の作業にも係るものであって良い。たとえば、パーソナルコンピュータやワードプロセッサなどのように、情報を生成したり処理する機能に直接関わっても良い。あるいは、前述したように入出力インターフェース回路１８０５を介して外部のコンピュータネットワークと接続し、たとえば数値計算などの作業を外部機器と協同して行っても良い。

【０１２５】また、入力部１８１４は、前記ＣＰＵ１８０６に使用者が命令やプログラム、あるいはデータなどを入力するためのものであり、たとえばキーボードやマウスのほか、ジョイスティック、バーコードリーダー、音声認識装置など多様な入力機器を用いる事が可能である。

【０１２６】また、デコーダ１８０４は、前記１８０７ないし１８１３より入力される種々の画像信号を３原色信号、または輝度信号とＩ信号、Ｑ信号に逆変換するための回路である。なお、同図中に点線で示すように、デコーダ１８０４は内部に画像メモリーを備えるのが望ましい。これは、たとえばＭＵＳＥ方式をはじめとして、逆変換するに際して画像メモリーを必要とするようなテレビ信号を扱うためである。また、画像メモリーを備える事により、静止画の表示が容易になる、あるいは前記画像生成回路１８０７およびＣＰＵ１８０６と協同して画像の間引き、補間、拡大、縮小、合成をはじめとする画像処理や編集が容易に行えるようになるという利点が生まれるからである。

【０１２７】また、マルチプレクサ１８０３は、前記ＣＰＵ１８０６より入力される制御信号にもとづき表示画像を適宜選択するものである。すなわち、マルチプレクサ１８０３はデコーダ１８０４から入力される逆変換された[illegible]

にもとづき駆動回路１８０１の動作を制御するための回路である。

【０１２９】まず、ディスプレイパネルの基本的な動作に係るものとして、たとえばディスプレイパネルの駆動用電源（図示せず）の動作シーケンスを制御するための信号を駆動回路１８０１に対して出力する。また、ディスプレイパネルの駆動方法に係るものとして、たとえば画面表示周波数や走査方法（たとえばインターレースかノンインターレースか）を制御するための信号を駆動回路１８０１に対して出力する。

【０１３０】また、場合によっては表示画像の輝度やコントラストや色調やシャープネスといった画質の調整に係る制御信号を駆動回路１８０１に対して出力する場合もある。

【０１３１】また、駆動回路１８０１は、ディスプレイパネル１８００に印加する駆動信号を発生するための回路であり、前記マルチプレクサ１８０３から入力される画像信号と、前記ディスプレイパネルコントローラ１８０２より入力される制御信号にもとづいて動作するものである。

【０１３２】以上各部の機能を説明したが、図１に例示した構成により、本表示装置においては多様な画像情報源より入力される画像情報をディスプレイパネル１８００に表示する事が可能である。すなわち、テレビジョン放送をはじめとする各種の画像信号はデコーダ１８０４において逆変換された後、マルチプレクサ１８０３において適宜選択され、駆動回路１８０１に入力される。一方、ディスプレイコントローラ１８０２は、表示する画像信号に応じて駆動回路１８０１の動作を制御するための制御信号を発生する。駆動回路１８０１は、上記画像信号と制御信号にもとづいてディスプレイパネル１８００に駆動信号を印加する。これにより、ディスプレイパネル１８００において画像が表示される。これらの一連の動作は、ＣＰＵ１８０６により統括的に制御される。

【０１３３】また、本表示装置においては、前記デコーダ１８０４に内蔵する画像メモリや、画像生成回路１８０７および情報の中から選択したものを表示するだけでなく、表示する画像情報に対して、たとえば拡大、縮小、回転、移動、エッジ強調、間引き、補間、色変換、画像の縦横比変換などをはじめとする画像処理や、合成、消去、接続、入れ換え、はめ込みなどをはじめとする画像編集を行う事も可能である。また、本実施例の説明[illegible]

産業用あるいは民生用として極めて応用範囲が広い。なお、同図は、表面伝導型放出素子を電子ビーム源とするディスプレイパネルを用いた表示装置の構成の一例を示したにすぎず、これのみに限定されるものでない事は言うまでもない。たとえば、図１の構成要素のうち使用目的上必要のない機能に係る回路は省いても差し支えない。またこれとは逆に、使用目的によってはさらに構成要素を追加しても良い。たとえば、本表示装置をテレビ電話機として応用する場合には、テレビカメラ、音声マイク、照明機、モデムを含む送受信回路などを構成要素に追加するのが好適である。

【０１３５】本表示装置においては、とりわけ表面伝導型放出素子を電子ビーム源とするディスプレイパネルの薄形化が容易なため、表示装置の奥行きを小さくすることができる。

【０１３６】それに加えて、表面伝導型放出素子を電子ビーム源とするディスプレイパネルは大画面化が容易で輝度が高く視野角特性にも優れるため、本表示装置は臨場感にあふれ迫力に富んだ画像を視認性良く表示する事が可能である。

【０１３７】

【発明の効果】以上説明した様に、本発明によれば、電子放出素子の電子放出特性が極めて安定となり、また放電による素子の劣化も防ぐことができた。

【０１３８】さらには、入力信号に応じて電子を放出する電子源においては、上記の電子放出素子を、基体上に複数個配置した電子源を構成することにより、また、個々の素子の両端を配線に接続した電子放出素子の行を複数もち、更に、変調手段を有している配置法、あるいは、基体に、互いに、電気的に、絶縁されたｍ本のＸ方向配線とｎ本のＹ方向配線とに、該電子放出素子の一対の素子電極とを接続した電子放出素子を複数個配列した配置とする電子源とすることで、各電子放出素子が、安定で、かつ、歩留まりよく製造できるようになった。

【０１３９】また、画像形成装置においては、入力信号にもとづいて、画像を形成する装置であって、少なくとも、画像形成部材と前記電子源より構成されたことを特徴とする画像形成装置であるため、電子放出特性の安定性と寿命の向上がなされ、例えば蛍光体を画像形成部材とする画像形成装置においては、高品位な画像形成装置例えば、カラーフラットテレビが、実現された。

【図面の簡単な説明】

【図１】[illegible]

価装置を示す図。

【図７】本発明に係る表面伝導型電子放出素子を示す図。

【図８】本発明に係る垂直型の表面伝導型電子放出素子を示す図。

【図９】本発明の電子源構成図。

【図１０】本発明の画像形成装置の斜視図。

【図１１】蛍光膜の説明図。

【図１２】単純マトリクス型電子源の平面図。

【図１３】単純マトリクス型電子源のA-A'断面図。

【図１４】単純マトリクス型電子源の製造工程（（ａ）－（ｄ））図。

【図１５】単純マトリクス型電子源の製造工程（（ｅ）－（ｉ））図。

【図１６】はしご型電子源の平面図。

【図１７】はしご型電子源を用いた画像形成装置の斜視図。

【図１８】単純マトリクス型電子源を用いた画像形成装置における真空支持体の斜視図。

【図１９】単純マトリクス型電子源を用いた表示パネルの駆動回路の構成図。

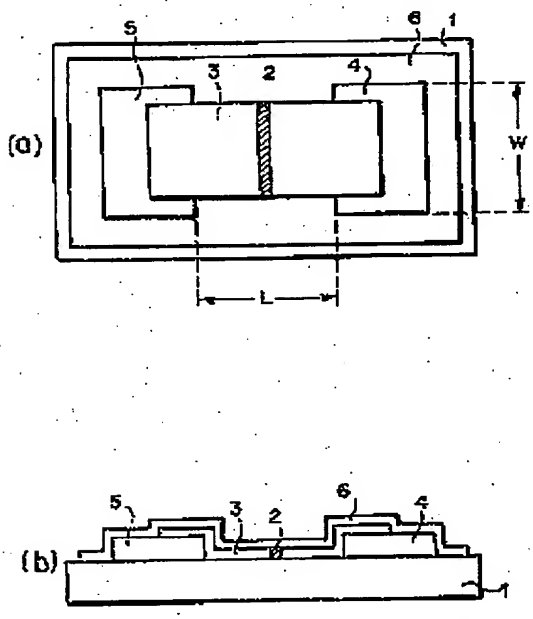
【図２０】本発明の画像表示装置のブロック図。

【図２１】従来の表面伝導型電子放出素子の平面図。

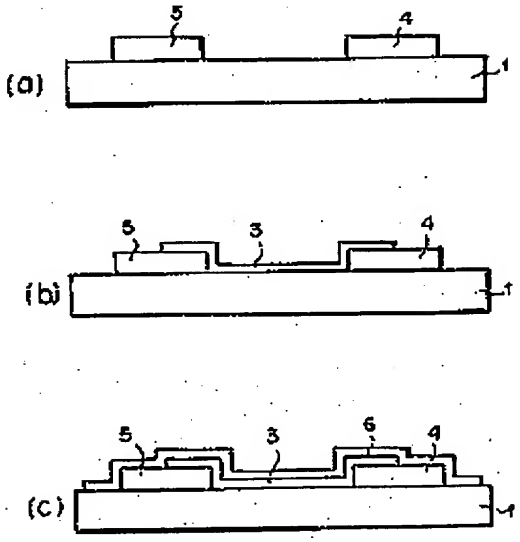
＊【符号の説明】

１　絶縁性基板
２　電子放出部
３　導電性薄膜
４、５　素子電極
６　炭素系薄膜
５０　アノード電極
６５　測定評価装置
６６　真空ポンプ
７０　高圧電源
８２　下配線
８３　上配線
９３　ガラス基板
９４　蛍光膜
９５　メタルバック
９６　フェースプレート
１３１　創刊絶縁膜
１３２　グリッド電極
１３３　空孔
１５１　コンタクトホール
２００　真空支持体

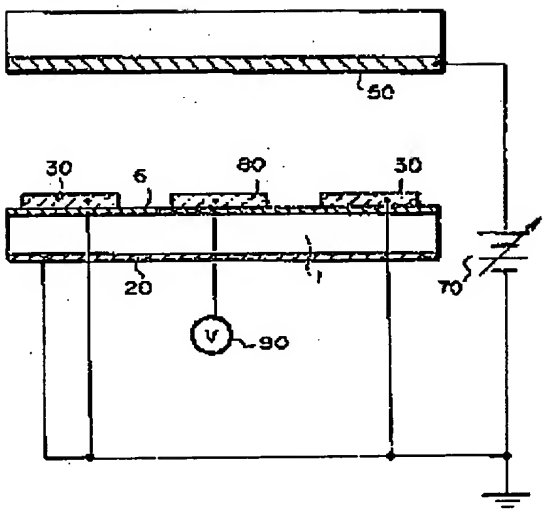
【図１】



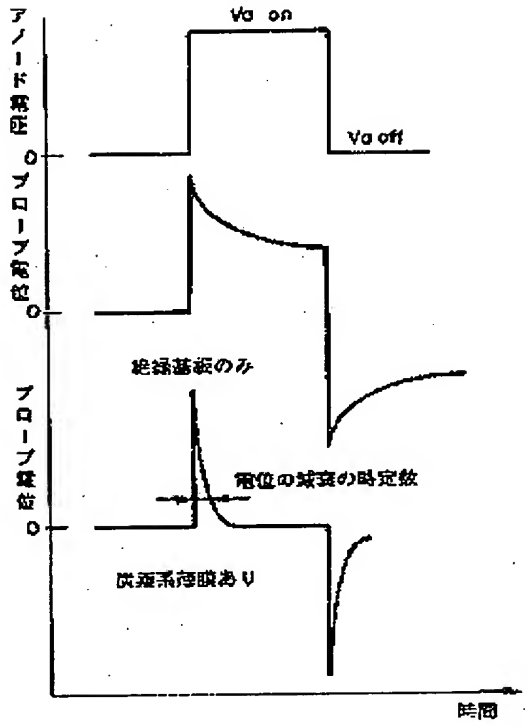
【図２】



【図３】



【図４】



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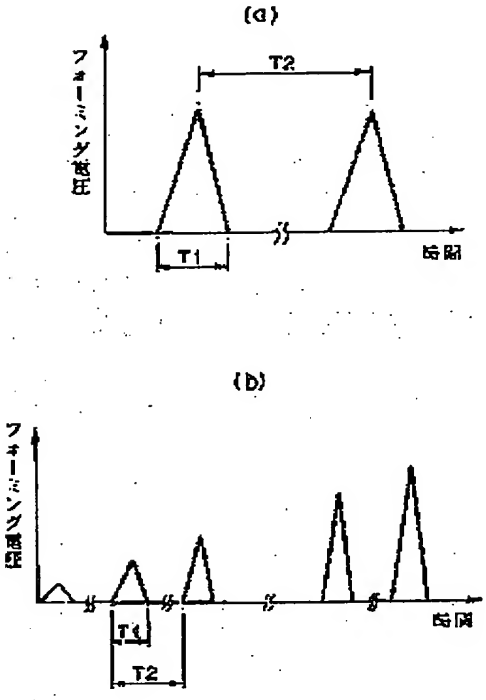
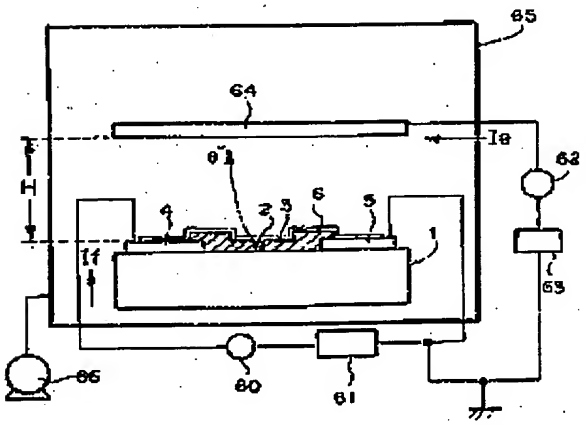
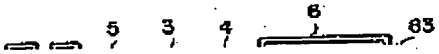


【図６】



【図８】

【図１３】



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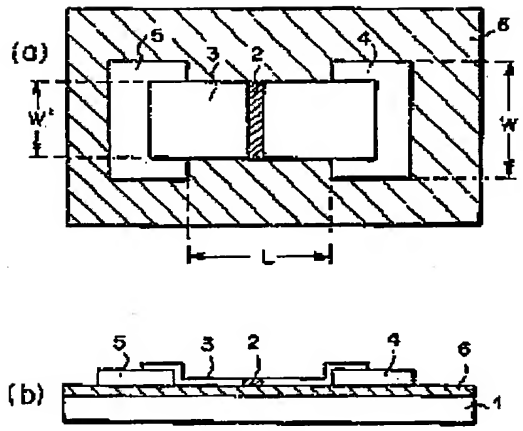
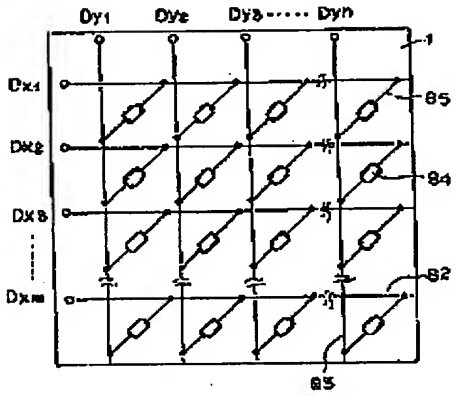
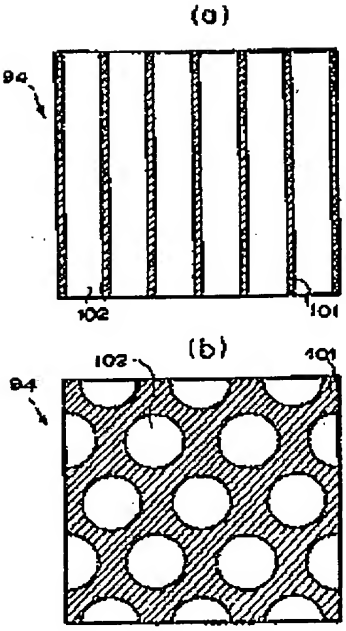


【図9】



【図11】



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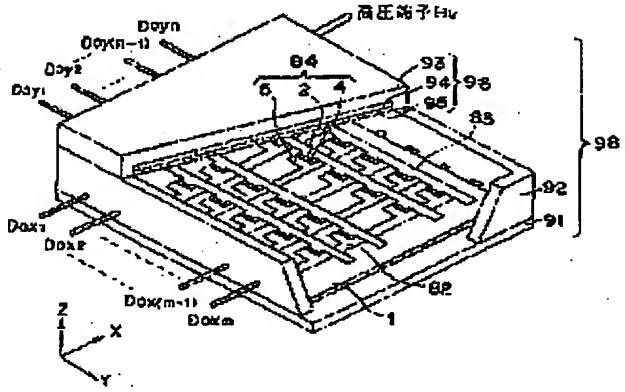

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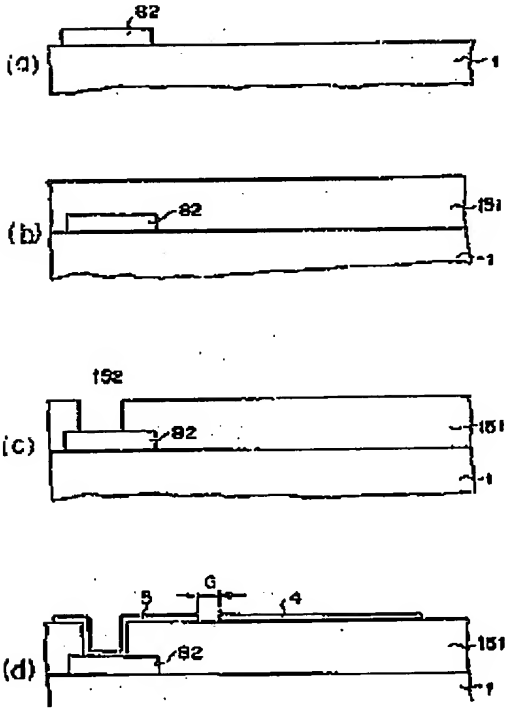
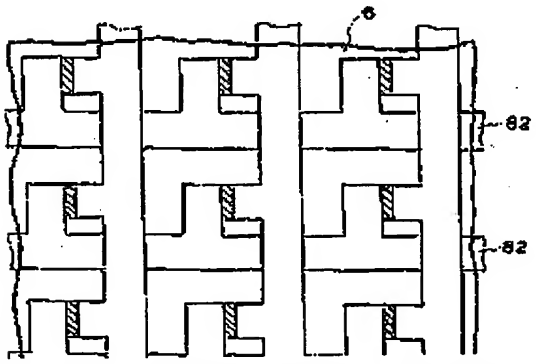
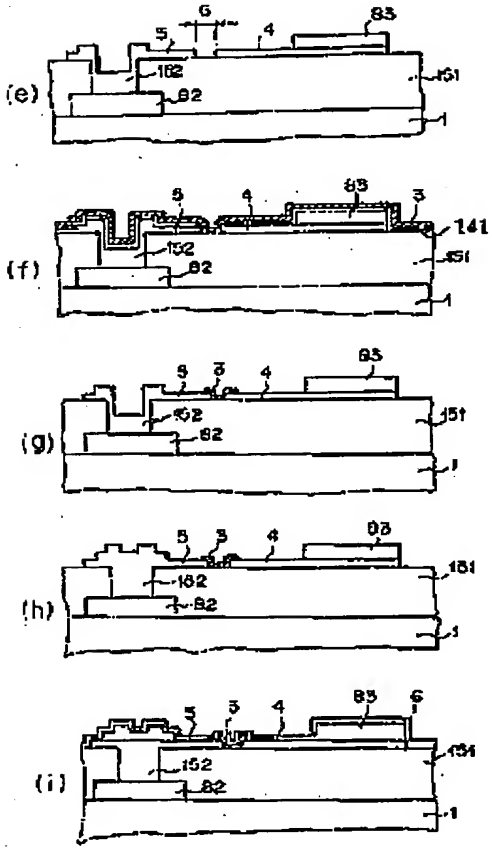


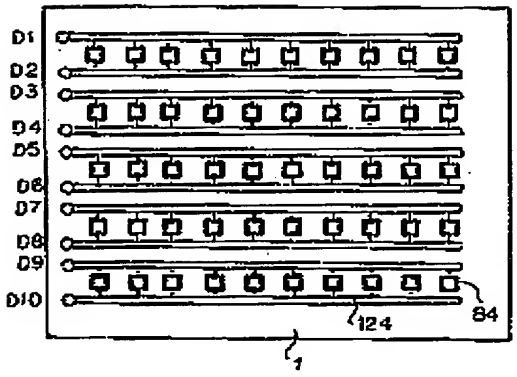
【図12】



【図１５】



【図１６】



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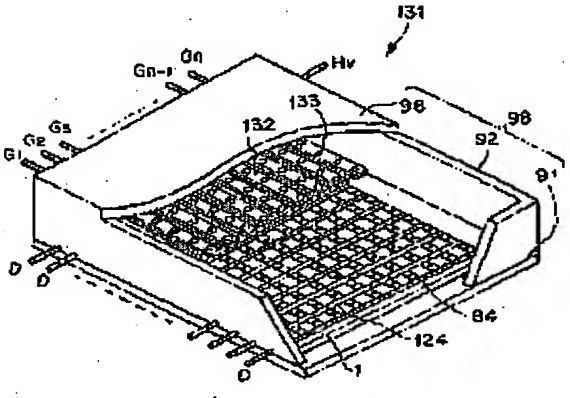
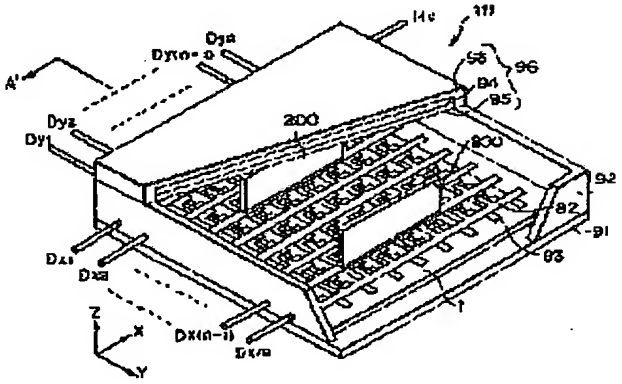
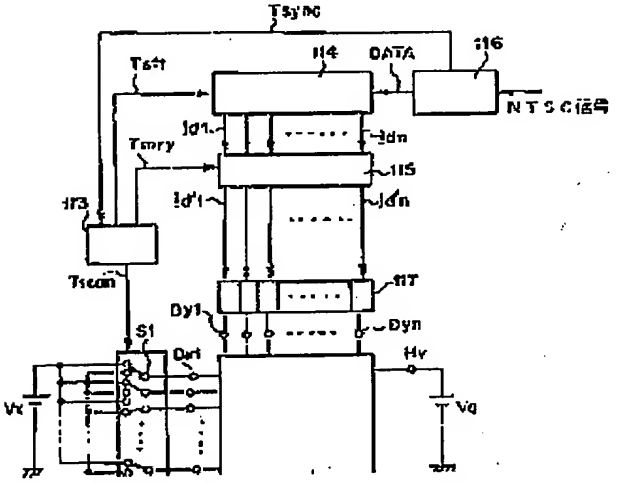


【図１８】

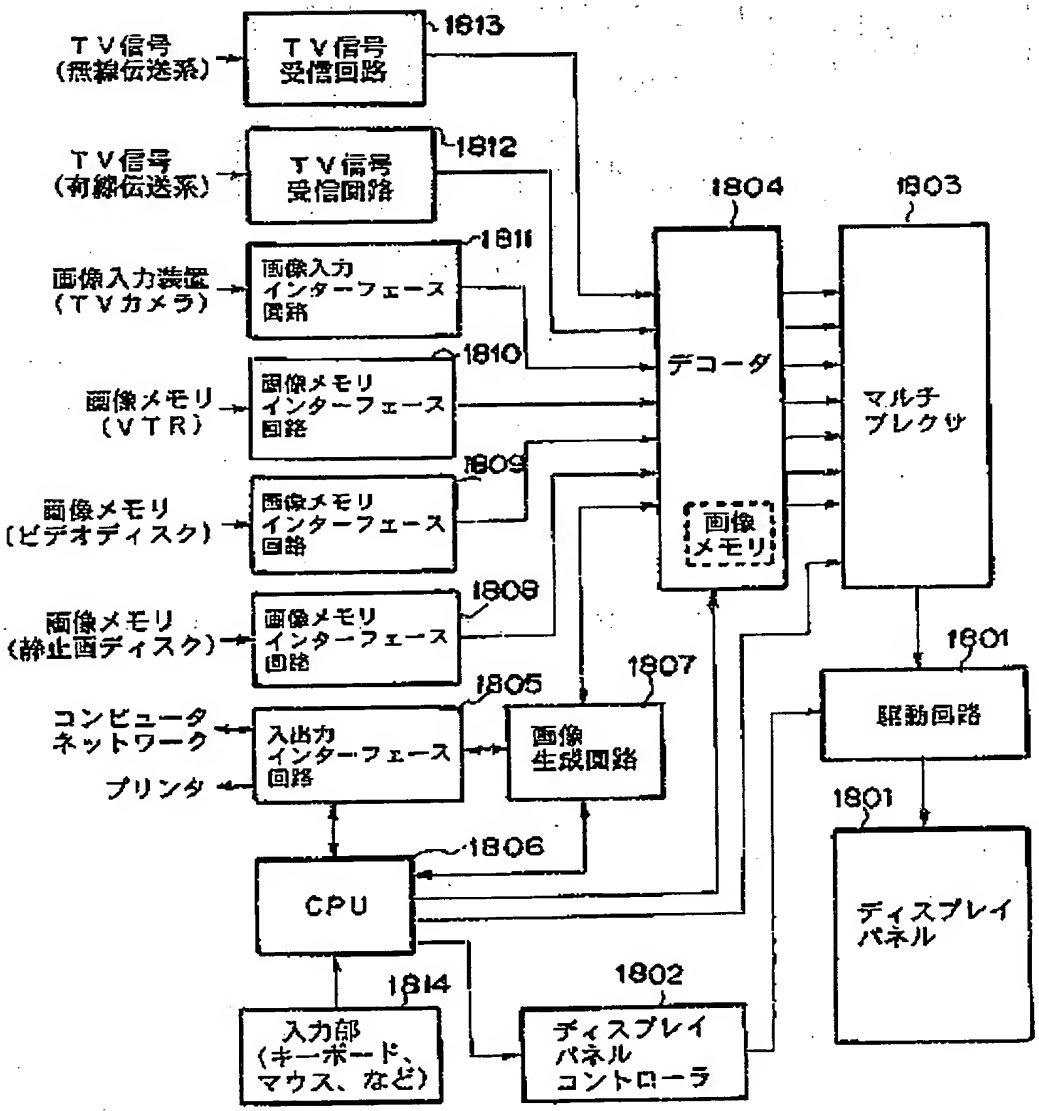


【図１９】



【図２１】

【図２０】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(無線伝送系)
ＴＶ信号
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(有線伝送系)
ＴＶ信号
受信回路
1812
画像入力装置
(ＴＶカメラ)
画像入力
インターフェース
回路
1811
画像メモリ
(ＶＴＲ)
画像メモリ
インターフェース
回路
1810
画像メモリ
(ビデオディスク)
画像メモリ
インターフェース
回路
1809
画像メモリ
(静止画ディスク)
画像メモリ
インターフェース
回路
1808
コンピュータ
ネットワーク
プリンタ
入出力
インターフェース
回路
1805
画像
生成回路
1807
CPU
1806
入力部
(キーボード、
マウス、など)
1814
ディスプレイ
パネル
コントローラ
1802
デコーダ
画像
メモリ
1804
マルチ
プレクサ
1803
駆動回路
1801
ディスプレイ
パネル
1801

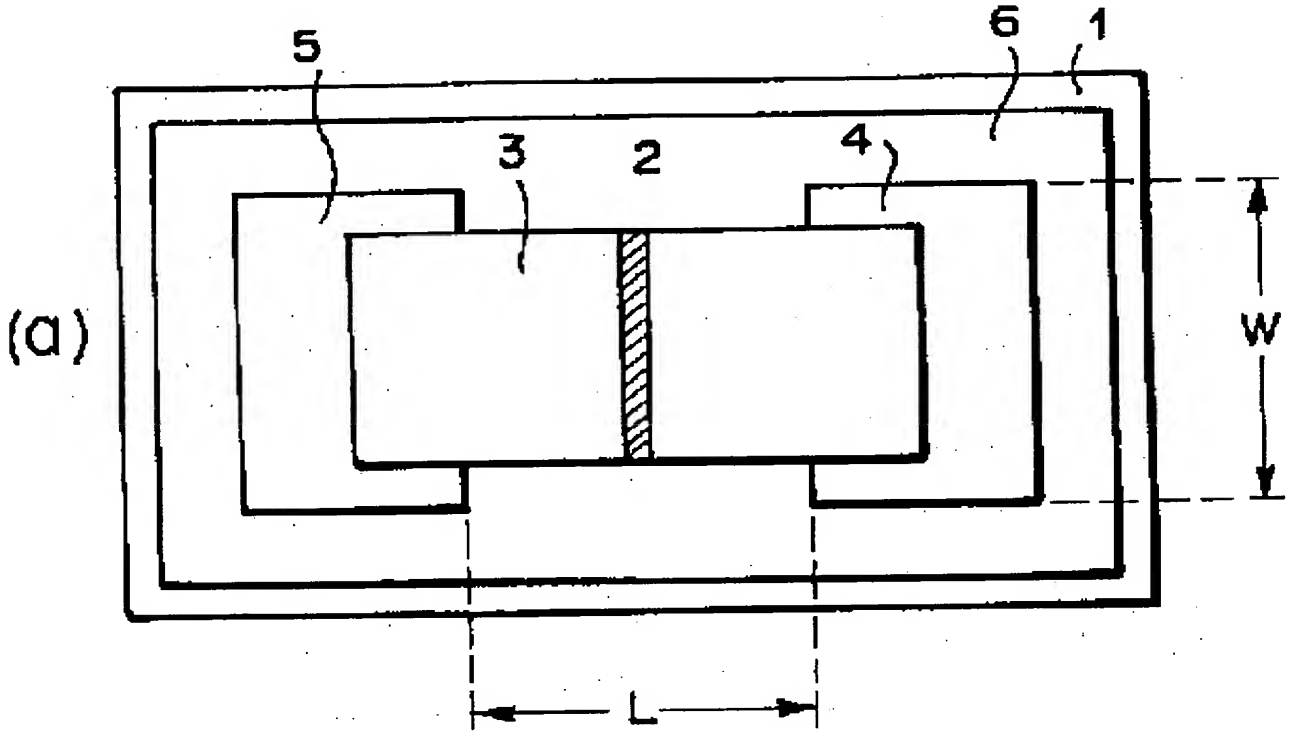
* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1] The electron emission component characterized by being formed on an insulating substrate, being the electron emission component which has the component electrode of the pair which counters, and a conductive thin film containing the electron emission section, arranging an anode on the location which counters said electron emission component, and forming a carbon system thin film in the front face or rear face of said electron emission component.
[Claim 2] Said electron emission component is an electron emission component according to claim 1 characterized by being a surface conduction mold electron emission component.
[Claim 3] The conductivity of said carbon system thin film is 104. Electron emission component according to claim 1 or 2 characterized by being 1010ohm/** from omega/**.
[Claim 4] The electron emission component according to claim 1 or 2 which characterizes said carbon system thin film as amorphous-ization, and is characterized by making it crystallize.
[Claim 5] It is image formation equipment which claim 1 thru/or 4 are the image formation layer values equipped with the electron source which prepared two or more electron emission components which have the carbon system thin film of a publication on said substrate either, and is characterized by said electron source forming said carbon system thin film in the front face of the base material which is installed into a vacuum and holds said vacuum.
[Claim 6] It is the manufacture approach of the electron emission component characterized by forming by providing a carbon system thin film, being the manufacture approach of an electron emission component of having the component electrode of the pair which was formed on the insulating substrate, and which counters, and a conductive thin film containing the electron emission section, carrying out electron emission of said carbon system thin film in an organic molecule, and carrying out an electron ray polymerization.
[Claim 7] It is the manufacture approach of the electron emission component which is the manufacture approach of an electron emission component of having the component electrode of the pair which possessed the carbon system thin film and was formed on the insulating substrate, and which counters, and a conductive thin film containing the electron emission section, and is characterize by forming said carbon system thin film by applying the solution which made the insulating ingredient distribute a graphite-like microcrystal.

[Translation done.]


(a)
5
6
1
3
2
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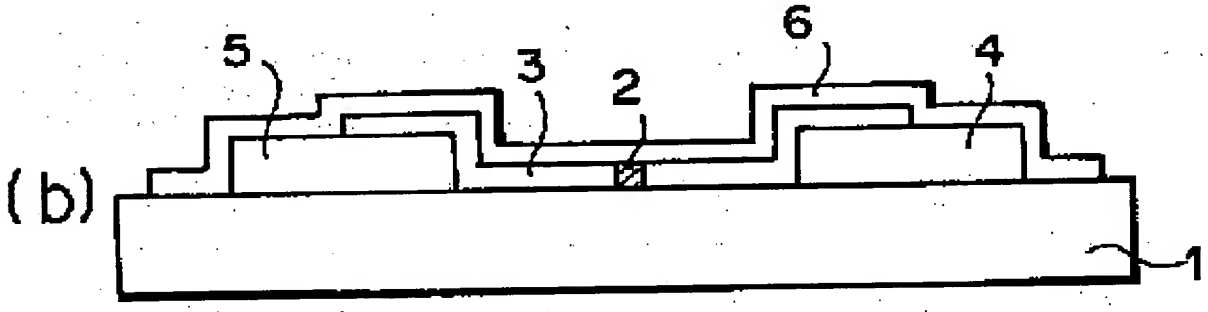
W
L


(b)
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* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] Especially this invention relates to the surface treatment for controlling discharge of an electron emission component about an electron emission component and its manufacture approach.
[0002]
[Description of the Prior Art] Conventionally, it divides roughly as an electron emission component, and two kinds of things using a thermionic emission component and a cold cathode electron emission component are known. There are a field emission mold (henceforth "FE mold"), a metal / insulating layer / metal mold (henceforth an "MIM mold"), a surface conduction mold electron emission component, etc. as cold cathode electron emission component. As an example of FE mold, W.P.Dyke & W.W.Dolan"Field emission" and the thing indicated by Advance in Electron Physics, 8 and 89 (1956) or C.A.Spindt, "PHYSICAL Properties of thin-film field emission cathodes with molybdenum cones", J.Appl.Phys., 47, 5248 (1976), etc. are known.
[0003] What was indicated by C.A.Mead, "Operation of Tunnel-Emission Devices", J.Apply.Phys, 32,646 (1961), etc. as an example of an MIM mold is known.
[0004] As an example of a surface conduction mold electron emission component mold, there are some which were indicated by M.I.Elinson, Radio Eng.Electron Phys., 10, 1290 (1965), etc.
[0005] A surface conduction mold electron emission component uses the phenomenon which electron emission produces for the thin film of the small area formed on the substrate by passing a current in parallel with a film surface. As this surface conduction mold electron emission component, it is SnO2 by said Elinson etc. The thing using a thin film, Thing [G. by Au thin film Dittmer: "Thin Solid Films", 9,317(1972)], In 2O3 / SnO2 Thing [M. by the thin film Hartwell and C.G.Fonstad: "IEEE Trans.ED Conf.", 519(1975)], Others [/ by the carbon thin film / thing [Araki **]: A vacuum, the 26th volume, No. 1, 22-page (1983)], etc. are reported.
[0006] Above-mentioned M. Hartwell's component configuration is typically shown in drawing 21 as a typical example of these surface conduction mold electron emission components. In this drawing, 1 is a substrate. 4 is a conductive thin film, it consists of a metallic-oxide thin film formed in the pattern of H mold configuration by the spatter, and the electron emission section 5 is formed of the energization processing called the below-mentioned energization foaming. In addition, 0.5-1mm and W' are set up for the component electrode spacing L in drawing by 0.1mm.
[0007] Conventionally, before performing electron emission in these surface conduction mold electron emission components, it was common to have formed the electron emission section 5 by energization processing beforehand called energization foaming in the conductive thin film 4. that is, with energization foaming, impression energization of the minute is carried out in direct current voltage or the about rising voltage /carried out very slowly, for example, 1v, to said conductive thin film 4 both ends, and a conductive thin film is destroyed, deformed or deteriorated locally -- making -- electric -- high -- it is forming the electron emission section 5 changed into the condition [****]. In addition, a crack generates the electron emission section 5 in some conductive thin films 4, and electron emission is performed from near [the] a crack. The surface conduction mold electron emission component which carried out said energization foaming processing impresses an electrical potential difference to the above-mentioned conductivity thin film 4, and makes an electron emit from the above-mentioned electron emission section 5 by passing a current for a component.
[0008] An above-mentioned surface conduction mold emission component has the advantage to which structure can carry out array formation of the a large number component ranging from it being simple and manufacture being easy to a large area. Then, various application in which this description can be employed efficiently is studied. For example, the source of an electric charge beam, a display, etc. are raised. As an example which carried out array formation of

many surface conduction mold emission components, a surface conduction mold electron emission component is arranged to juxtaposition, and the electron source which carried out the line array of many lines which are wiring (it is also called common wiring) and connected the both ends of each component, respectively is raised so that it may mention later (for example, JP,64-031332,A, JP,1-283749,A, a No. 257552 [two to] official report, etc.).

[0009] Moreover, especially, in image formation equipments, such as a display, there is a trouble of having to have a back light, since it is not a spontaneous light type, although the Taira stencil ****** using liquid crystal has replaced and spread through CRT in recent years, and development of a spontaneous light type display has been desired. The image formation equipment which is a display which combined the fluorescent substance which makes the light emit light with the electron emitted as a spontaneous light type display from the electron source which has arranged many surface conduction mold emission components, and the electron source is raised (for example, USP5,066,883).

[0010]

[Problem(s) to be Solved by the Invention] However, in thin image formation equipment, the above-mentioned electron emission component carries out incidence of the electron ray accelerated by the fluorescent substance, and obtains brightness. These electron emission components are dealt with in a vacuum. As one factor of the instability of the electron emission characteristic in the inside of a vacuum, if the insulating substrate front face is exposed near the electron emission section, it is described by JP,02-072534,A by these people that electron emission becomes unstable since the potential of the front face becomes unstable.

[0011] In the image formation equipment which answers according to an input signal, since it is necessary to separate each electron emission component electrically, an insulating substrate is usually used. However, if high pressure is applied to the fluorescent substance in the image display section, the potential by the capacitive component rate decided by the dielectric constant of a vacuum and an insulator will generate the surrounding insulating side of the electron emission component which counters. If this potential has good insulation, a certain forge-fire time constant is long, and it has been charged.

[0012] Furthermore, if an electron is emitted from an electron emission component in this condition, an electron will collide also with the electrified insulating side. From an electron being accelerated, if charged particles, such as an electron and ion, are injected into the above-mentioned insulating substrate front face, a secondary electron will occur. Especially, under high electric field, since it results in abnormality discharge, the electron emission characteristic of a component falls remarkably, and when the worst, it is confirmed experimentally that a component breaks. Although there is a point still unknown about this abnormality discharge phenomenon, electronic multiplication is carried out in [secondary electron emission] **** in respect of the insulation for which the front face was charged or charged by impregnation of the electron emitted from the component, ion, etc., and it is possible to discharge.

[0013] In order to prevent the instability of the electron emission characteristic in the inside of these vacuums, and discharge degradation of a component, it is effective to cover with the coat (antistatic film) of a suitable conductor so that an insulating front face may not be exposed, but since leakage current flows to component inter-electrode with this coat, the effectiveness of the appearance of a component falls. Effectiveness puts a current ratio with the current (it is henceforth called the electron emission current Ie) emitted into the vacuum over the flowing current (it is henceforth called the component current If) here, when an electrical potential difference is impressed to the component electrode with which the pair of a surface conduction mold electron emission component counters.

[0014] That is, although a component current is small as much as possible and the large thing of the emission current as much as possible is desirable, since the leakage current of the above-mentioned antistatic film is added to a component current, effectiveness falls.

[0015] Furthermore, the secondary electron emitted when a charge and an electron are poured in depends with an ingredient, and, as for an ingredient, it is desirable to choose an ingredient with few this secondary-electron-emission multiplier.

[0016] A technique in which forming such a small coat that electrification being prevented and leakage current not becoming a parenchyma top problem in order to solve these troubles can form the thickness of the coat of an ingredient with few secondary-electron-emission multipliers and resistance in homogeneity in the condition of having controlled with a sufficient precision, preferably is desired.

[0017] If the stability of the electron emission characteristic and improvement in a life are made as mentioned above, it will realize in the image formation equipment which uses a fluorescent substance as an image formation member, for example, high-definition image formation equipment, for example, flat television.

[0018] Then, this invention makes it the technical problem to offer the electron source and image formation equipment using a configuration, a process, and it of a surface conduction mold electron emission component with sufficient stability.

[0019]
[Means for Solving the Problem] This inventions for solving the above-mentioned technical problem are the electron-emission component which covered the insulating substrate front face of the electron emission section circumference to the carbon system thin film, and its manufacture approach, and he is trying to form a carbon system thin film on the insulating base of this surface conduction mold electron emission component in the surface conduction mold electron-emission component which has the component electrode of the pair which was formed on the insulating base, and which counters, and a conductive thin film containing the electron emission section in detail.
[0020] Furthermore, specifically, it is the conductivity of a carbon system thin film 104 It is considering as omega/** to 1010ohm/**.
[0021] Moreover, said carbon system thin film is made to make it amorphous, or it is made to crystallize.
[0022] Moreover, according to an input signal, it is made to ****** a carbon system thin film on the wall surface of the base material of the container holding a vacuum in this invention in a fluorescent substance and the image-formation equipment which consisted of electron sources in the equipment which forms an image at least using the electron source which prepared two or more surface conduction mold electron emission components on the substrate.
[0023] Moreover, he carries out electron emission of this carbon system thin film in an organic molecule, and is trying to form a carbon system thin film by the electron ray polymerization in this invention in the manufacture approach of surface conduction type ********** which has the component electrode of the pair which was formed on the insulating base possessing a carbon system thin film, and which counters, and a conductive thin film containing the electron emission section.
[0024] Moreover, he makes an insulating thin film distribute a graphite-like microcrystal, and is trying to form in this invention in the manufacture approach of a surface conduction mold electron emission component of having the component electrode of the pair which was formed on the insulating base possessing a carbon system thin film and which counters, and a conductive thin film containing the electron emission section.
[0025]
[Embodiment of the Invention] Hereafter, the operation gestalt of this invention is explained with reference to a drawing.
[0026] Drawing 1 a and b is the top views and sectional views showing the configuration of a fundamental surface conduction mold electron emission component, respectively. With reference to drawing 1 , the fundamental configuration of the component concerning this invention is explained. As for the thin film with which a substrate, and 4 and 5 contain a component electrode and, as for 3, 1 contains the electron emission section in drawing 1 , and 2, the electron emission section and 6 are carbon system thin films. The thin film 3 which contains the electron emission section here is 107. It is desirable that the sheet resistance below omega/** is shown. The sheet resistance of the thin film 3 containing this electron emission section is restricted as resistance which can form the good electron emission section in the formation process, i.e., the foaming process, of the electron emission section 2 mentioned later. It is 103 in order to form the good electron emission section. It is 107 more than omega/**. It is desirable that they are omega / below ** resistance. However, after forming the electron emission section 2, it is desirable that the electrical potential difference impressed through a component electrode is fully impressed to the electron emission section 2, and the lower one of the resistance of the thin film 3 containing the electron emission section is desirable. for this reason, the thin film 3 which contains the electron emission section although mentioned later in detail -- 103 more than omega/** -- 107 as a metal oxide semiconductor thin film with the resistance below omega/** -- forming -- after foaming -- returning -- more -- low -- it can use as a metal thin film [****]. Therefore, especially the minimum of the resistance of the thin film 3 containing the electron emission section of final ** is not limited. In addition, the resistance of the thin film 3 containing the electron emission section said here means the resistance measured in the field which does not contain the electron emission section 2.
[0027] On the other hand, the carbon system thin film 6 is a carbon system thin film which uses carbon as a principal component, and is 104. It is desirable that it is resistance of omega/** - 1010ohms / **. In the electronic appearance property of a component, the smaller one in the ability to do of a component current is desirable so that this may be mentioned later, therefore the resistance of the charcoal system thin film 6 is 108. It is desirable that they are omega/**. Moreover, in order for the carbon system thin film 6 to have the **** number of secondary-electron-emission systems, it is desirable that it is the resistivity below 1010ohms / **.
[0028] In addition, drawing 8 is drawing showing the surface conduction mold electron emission component of the vertical type concerning this invention, and the electron emission section 2 of it is the same as that of the electron emission component of drawing 1 except for the point currently formed at right angles to a substrate 1.
[0029] Next, with reference to drawing 2 , the manufacture approach is explained for order later on.

[0030] First, a substrate 1 is washed and the component electrodes 4 and 5 are formed (drawing 2 (a)).
[0031] Next, the thin film 3 for electron emission section formation is formed (drawing 2 (b)).
[0032] Next, the carbon system thin film 6 is formed (drawing 2 (c)). A carbon material can use suitably so that that from which the easy and film uniform to a large area is obtained may be desirable and may mention a thin film with few secondary-electron-emission multipliers later as an ingredient of the carbon system thin film 6. In addition, this process may be performed before formation of the thin film 3 for electron emission section formation. Generally, in order to be easy to become a ****** organization and to acquire desired sheet resistance, a thin film is continuation and its uniform thin film is desirable. The carbon thin film is convenient at this point. If a carbon thin film has 1nm or more of thickness, becoming uniform by the continuation film is confirmed experimentally. Furthermore, it is known that the secondary-electron-emission multiplier of carbon is also small. As the formation approach of a carbon thin film, a spatter, vacuum evaporation technique, the applying method, the polymerization method by the electron beam by carbon system gas or the plasma method, a CVD method, etc. are raised. By every approach of these, the stable carbon thin film is obtained easily. In addition, an example describes detailed membrane formation.
[0033] Next, by foaming, the electron emission section 2 is formed and activation is performed (drawing 2 (d)).
[0034] In the above, the manufacture approach of the electron emission component of this invention was explained.
[0035] In addition, the fundamental property of an electron emission component is not influenced by formation of the carbon system thin film 6 in this invention. Since this has the resistance of the carbon system thin film 6 high enough (more than 108ohms / **), the leakage current which flows through the carbon system thin film 6 is because it is sufficiently small compared with the component current observed while performing electron emission.
[0036] Moreover, if it depends on this operation gestalt, even if electrification of an insulating substrate front face is prevented and it is charged, since the secondary-electron-emission multiplier is small, the **** abnormality discharge by electronic multiplication can be controlled. For this reason, since the instability of the electron emission characteristic resulting from the potential instability of an insulating front face and discharge between the anodes near the component are controlled, the stable electron emission characteristic of long duration is acquired.
[0037] Since the electron emission component which starts this invention as mentioned above has an increment property in monotone over the component applied voltage of the stable electron emission characteristic If, i.e., a component current, and the emission current Ie over long duration, it can expect the application to the direction of many.
[0038] As mentioned above, although the fundamental configuration of a surface conduction mold electron emission component and the process were described, if it has three descriptions in the property of a surface conduction mold electron emission component according to the thought of this invention, it is not limited to an above-mentioned configuration etc., but can apply also in image formation equipments, such as the below-mentioned electron source and a display.
[0039]
[Example] (Example 1) The configuration of the fundamental surface conduction mold electron emission component concerning this invention is the same as that of the top view of drawing 1 a and b, and a sectional view.
[0040] The manufacturing method of the surface conduction mold electron emission component concerning this invention is the same as that of drawing 2 fundamentally. Hereafter, with reference to drawing 2 , the fundamental configuration and fundamental manufacturing method of a component concerning this invention are explained.
(Process - a) On the substrate 1 which formed silicon oxide with a thickness of 0.5 microns with the CVD method on the defecated blue plate glass, photoresist (RD-2000N-41 Hitachi Chemical Co., Ltd. make) formation of the pattern which should serve as the component electrodes 4 and 5 and the component inter-electrode gap G was carried out, and the sequential deposition of Ti with a thickness of 50A and the Pt with a thickness of 1000A was carried out with the vacuum deposition method. The photoresist pattern was dissolved by the organic solvent, lift off of the Pt/Ti deposition film was carried out, and the component electrode spacing L1 was made into 10 microns, and formed the component electrodes 4 and 5 which have 300 microns for the width of face W1 of a component electrode.
(Process - b) The mask of the thin film 3 for electron emission section formation of the electron emission component concerning this process was a mask which has opening in the electrode gap L1 between components, and this near, carried out Cr film of 10nm of thickness deposition and patterning vacuum deposition with this mask, and carried out heating baking processing for 12 minutes for organic [Pd] (ccp4230 Okuno Pharmaceuticals company make) at rotation spreading and 300 degrees C with the spinner on it. Moreover, the thickness of the thin film 4 for electron emission section formation which consists of a particle which consists of Pd as a main element formed in this way is 100A, and sheet resistance is 2x104. They were omega/**. In addition, as the particle film described here was mentioned above, it is the film with which two or more particles gathered, and not only the condition that the particle

distributed separately but a particle puts mutually contiguity or the film in the condition (the shape of an island is also included) of having overlapped, as the fine structure, and the particle size means the path about the particle which can recognize particle shape in said condition.
(Process - c) Cr film and the thin film 3 for electron emission section formation after baking were etched by acid etchant, and the desired pattern was formed.
[0041] The component electrodes 4 and 5 and the thin film 3 grade for electron emission section formation were formed on the substrate 1 according to the above process.
(Process - d) The substrate 1 in which the component electrodes 4 and 5 and the thin film 3 for electron emission section formation were formed was washed again, and after making it dry, the carbon system thin film 6 covered the whole front face of a substrate 1 by the approach described below.
[0042] The carbon thin film was formed by RF magnetron sputtering. The used target is C (99.99% of purity). The used gas is Ar, it is Ar partial pressure 5mTorr, and spatter power is 5W/**. In addition, the conte low of the thickness is carried out by spatter time amount.
[0043] and **** -- the same -- a carbon thin film -- a glass substrate top -- respectively -- 1nm -- 20nm formed membranes and 10nm of 5nm of 3nm of 2nm of thin films of C was obtained. When the sheet resistance of the substrate of the number of each class is measured by four probes, at the time of 1nm of thickness - 5x108 the time of omega/**, and 2nm of thickness -1x108 the time of omega/**, and 3nm of thickness -- 6x107 the time of omega/**, and 5nm of thickness -- 4x107 the time of omega/**, and 10nm of thickness -- 2x107 the time of omega/**, and 20nm of thickness -- 1x107 They were omega/**. In addition, the relation of the thickness value and resistance of these carbon system thin films can change spatter conditions, or can also change them by heat treatment, ambient atmosphere processing, etc., and the above-mentioned relation is not universal.
[0044] Moreover, in order to evaluate the situation of electrification of a carbon system thin film, the weighting network shown in drawing 3 was. 1 is the substrate of an insulator and an electrode for 20 to take a gland from the rear face of an insulator substrate and 30 are grounded to the gland with the electrode. 6 is a carbon system thin film. 80 is a probe electrode for seeing the situation of electrification, and this potential is connected to surface potential 90 [a total of]. 50 is connected with the high voltage power supply 70 with the anode electrode. Such system of measurement has a substrate and an anode electrode in a vacuum housing, and it is measured in a vacuum.
[0045] This result is explained with reference to drawing 4 . When the anode electrical potential difference Va is impressed to a certain time of day from a high voltage power supply 6 and there is no carbon system thin film 4 that is, only in the case of an insulating substrate, the potential of a probe electrode is divided by the capacity decided by the vacuum, the dielectric constant of an insulating substrate, and distance of space, and is charged in electropositive potential. The more insulation is high, the more this electropositive potential is saved for a long time. Moreover, if the anode electrical potential difference Va is turned OFF, it will be charged in electronegative potential.
[0046] For example, when about 5kV of Va(s) is impressed, probe potential requires a high electrical potential difference for probe inter-electrode 8 as the electrode 3 which may increase by 2kV or more and has been grounded in this case, and as a result, dielectric breakdown of it may be carried out, and it may discharge.
[0047] On the other hand, if a carbon system thin film is formed on an insulating substrate, potential will decline with a certain time constant like drawing 4 . Supposing the same configuration of this time constant, i.e., capacity, is the same, it will decrease with the time constant decided by resistance of a carbon system thin film, and potential is set to 0V. If potential is 0V, since the high potential difference is not produced in each electrode, dielectric breakdown will not be carried out.
[0048] The situation of electrification when setting thickness of an above-mentioned carbon system thin film to 1nm - 20 nm based on this measurement was measured. Consequently, in every thickness, it turned out that electrification is decreased immediately. Incidentally the damping time at the time of 1nm was about 10ms. Moreover, in every thickness, the structure of a thin film was the continuation film and was electrically good. [of connection]
[0049] The conductivity of a carbon system thin film is 104 experimentally. When it was 1010ohms / ** extent from omega/**, the damping time is 1 or less s, and it became clear that dielectric breakdown was not carried out even if it raises about 20kV of high pressures.
[0050] Thickness of a carbon system thin film was set to about 1nm by above-mentioned examination.
(Process - e) Next, in process-e which is not illustrated to drawing 2, after having installed in the measurement evaluation equipment shown in drawing 6 , exhausting with the vacuum pump and reaching the degree of vacuum of 2x10-5Torr, between the component electrode 4 of a component, and 5, the electrical potential difference was impressed and energization processing (foaming processing) was carried out from the power source 31 for impressing the component electrical potential difference Vf to a component. The voltage waveform of foaming processing is

shown in drawing 5 .
[0051] T1 and T2 were the pulse width and pulse separations of a voltage waveform among drawing, in this example, T1 was made into 1 ms, they made T2 10 mses, the pressure up of the peak value (peak voltage at the time of foaming) of a square wave was carried out at 0.1V step, and it performed foaming processing. Moreover, during foaming processing, to coincidence, it was the electrical potential difference of 0.1V, and the resistance measurement pulse was put among T2, and resistance was measured. in addition, termination of foaming processing -- the measured value in a resistance measurement pulse -- about 1 -- it considered as the time of becoming M ohms or more, and impression of the electrical potential difference to a component was ended to coincidence. The foaming electrical potential difference VF at this time was 5.0V.
[0052] Then, holding a component in a vacuum, annealing was carried out at 150 degrees C, and the thin film 3 and the carbon thin film 6 containing the electron emission section were returned to coincidence.
(Process - f) Then, in process-f which is not illustrated to drawing 2, what confined the acetone in ampul was introduced in the vacuum through the slow leak bulb, and 1.0x10-3Torr was maintained.
[0053] Next, activation was carried out to the component which carried out foaming processing, having changed into the square wave the triangular wave shown in drawing 5 , and having used the peak value as 14V.
[0054] In activation, the pulse voltage was impressed to component inter-electrode within the measurement evaluation equipment shown in drawing 6 , measuring the component current If and the emission current Ie. Since effectiveness eta (Ie/Ifx100%) became max in about 30 minutes, energization was stopped, the slow leak bulb was shut and activation was ended.
(Process - g) In this way, the electron emission section 2 was formed, the electron emission component 84 was produced in process-g which is not illustrated to drawing 2, and the electron emission characteristic was evaluated.
[0055] In addition, the degree of vacuum in 5000V and the vacuum devices at the time of electron emission characteristic measurement was set [the distance between an anode electrode and an electron emission component] to 1x10-8Torr for the potential of 4mm and an anode electrode. Although the component electrical potential difference was impressed 14V among the electrodes 5 and 6 of a component, the electron emission characteristic was very stable and destruction of the component by discharge etc. was not produced.
[0056] In addition, when the sample which does not have a carbon system thin film for a comparison was evaluated, the temporal response of the amount of electron emission was large, and discharge arose within 5 hours, and the component broke.
[0057] As mentioned above, with the carbon system thin film by this invention, it was stable and the electron emission characteristic which discharge does not produce was acquired.
(Example 2) This example describes the sample which formed the carbon system thin film in the substrate first, as shown in drawing 7 .
(Process - a) The spin coat of the water solution of the thing of carbon distribution ingredient (particle size of 0.1 micrometers) marketing was carried out on the defecated blue plate glass 1. A carbon distribution ingredient is TiO2 in order to lower conductivity by using a graphite as a principal component. What is added was used. With spin coat conditions and water-solution concentration, the carbon system thin film 6 of various thickness can be formed. In order to stabilize this carbon system thin film, it heat-treated at 200 degrees C. In order to make it optimization by the relation between thickness and resistance, having called the carbon system thin film here Since carbon is made to mix an impurity and it carries out adjustable [of the resistivity], are calling it the carbon system thin film. Photoresist (RD-2000N-41 Hitachi Chemical Co., Ltd. make) formation of the pattern which should serve as the component electrodes 4 and 5 and the component inter-electrode gap G on the blue plate glass substrate 1 covered with the produced carbon system thin film is carried out. Thus, with a vacuum deposition method The sequential deposition of Ti of thickness 50A and the Pt of thickness 1000A was carried out. The photoresist pattern was dissolved by the organic solvent, lift off of the Pt/Ti deposition film was carried out, and the component electrode spacing L1 was made into 10 microns, and formed the component electrodes 4 and 5 which have 300 microns for the width of face W1 of a component electrode.
[0058] When the sheet resistance of a substrate to various thickness is measured by four probes, at and the time of 0.1 micrometers of thickness 8x108 the time of omega/**, and 0.2 micrometers of thickness -- 1x108 the time of omega/**, and 0.4 micrometers of thickness -- 5x107 the time of omega/**, and 0.6 micrometers of thickness -- 1x107 the time of omega/**, and 1.0 micrometers of thickness -- 2x107 omega/** -- it came out. In addition, the relation of these thickness and resistance can change the impurity ingredient and the mixed ratio in a graphite, or can also change them on spin coat conditions, water-solution concentration, heat treatment conditions, etc., and the above-mentioned relation is not universal.

[0059] Moreover, potential measurement to various thickness was performed like the example 1. Also in this case, potential was decreased in 10 or less ms of time constants in every thickness, and it turned out that it is 0V.
[0060] in order [moreover,] to evaluate the crystallinity of the produced carbon system thin film -- an X diffraction and Raman -- the spectrum was performed. Consequently, in 0.4 micrometers or less, it became clear amorphous one and in 0.4 micrometers or more that it was mixing of a crystal as it is amorphous.
[0061] Furthermore, electron beam irradiation was performed on the substrate of each above-mentioned thickness carbon system thin film, and the secondary-electron-emission multiplier was measured. When incidence of the electron ray was carried out by 5kV, the secondary-electron-emission multiplier was one or less in thickness 0.2 micrometers or more.
[0062] At the time of 0.1 micrometers, the secondary-electron-emission multiplier became two or more, and the electrification phenomenon reflected in the property of a substrate substrate was observed.
[0063] The carbon system thin film which has 0.4-micrometer thickness by this example by the above two examination was used.
[0064] Furthermore, process given in the first example in this example - e, process - The electron emission component was produced at the same process as f and process-g. In this electron emission component, although the degree of vacuum in 6000V and the vacuum devices at the time of electron emission characteristic measurement was set [the distance between an anode electrode and an electron emission component] to 1x10-8Torr for the potential of 2.8mm and an anode electrode and the component electrical potential difference was impressed 14V between the electrode of a component, and 6, the electron emission characteristic was very stable and destruction of the component by discharge etc. was not produced.
[0065] In addition, when the sample similarly produced except not forming the carbon system thin film 6 for the comparison was evaluated, abnormality discharge arose within 1 hour and the component destroyed the sample without a carbon system thin film.
[0066] As mentioned above, with the antistatic film by this invention, it was stable and the electron emission characteristic which discharge does not produce was acquired. Moreover, it became clear to coincidence that the antistatic film by this invention is amorphous or that crystallinity was sufficient.
(Example 3) This example is an example of the image formation equipment which carried out passive-matrix arrangement of many surface conduction electron emission components.
[0067] Some top views of an electron source are shown in drawing 12 . Moreover, the A-A' sectional view in drawing is shown in drawing 13 . However, what showed the same notation by drawing 12 R> 2 and drawing 13 shows the same thing. For the direction wiring of X corresponding to Dxn of drawing 9 in 82 corresponding to a substrate in 1 (it is also called bottom wiring), the direction wiring (it is also called upper wiring) of Y corresponding to Dyn of drawing 9 in 83, the thin film with which 3 contains the electron emission section, and 4 and 5, as for the antistatic film and 131, a component electrode and 6 are [a layer insulation layer and 152] the contact holes for the electrical installation of the component electrodes 4 and 5 and the bottom wiring 82 here.
[0068] Next, the manufacture approach is concretely explained with reference to drawing 14 and drawing 15 according to the order of a process.
(Process - a) On the substrate 1 which formed silicon oxide with a thickness of 0.5 microns by the spatter on the defecated blue plate glass After BEKU [carrying out the laminating of Cr of thickness 50A, and the Au of thickness 6000A one by one with vacuum deposition and / it / with a spinner / rotation-applying a photoresist (AZ1370 Hoechst A.G. make) and], a photo mask image is exposed and developed. The resist pattern of the bottom wiring 82 is formed, wet etching of the Au/Cr deposition film is carried out, and the wiring 82 under a desired configuration is formed.
(Process - b) The layer insulation layer 151 which consists of silicon oxide with a thickness of 1.0 microns next is deposited by RF spatter.
(Process - c) The photoresist pattern for forming a contact hole 152 in the silicon oxide deposited at Process b is made, the layer insulation layer 151 is etched by making this into a mask, and a contact hole 152 is formed. Etching is CF4. H2 It was based on the RIE (Reactive Ion Etching) method using gas.
(Process - d) After that, photoresist (RD-2000N-41 Hitachi Chemical Co., Ltd. make) formation of the pattern which should serve as the component electrodes 4 and 5 and the component inter-electrode gap G was carried out, and the sequential deposition of Ti with a thickness of 50A and the nickel with a thickness of 1000A was carried out with the vacuum deposition method. The photoresist pattern was dissolved by the organic solvent, lift off of the nickel/Ti deposition film was carried out, and the component electrode spacing L1 was made into 3 microns, and formed the component electrodes 4 and 5 which have 300 microns for the width of face W1 of a component electrode.
(Process - e) After forming the photoresist pattern of the upper wiring 83 on the component electrodes 4 and 5, Ti with

a thickness of 50A and Au with a thickness of 5000A were deposited with vacuum deposition one by one, lift off removed the unnecessary part, and the upper wiring 83 of a desired configuration was formed.
(Process - f) The mask of the thin film 2 for electron emission section formation of the electron emission component concerning this process was a mask which has opening in electrode gap between components G, and this near, carried out the Cr film 141 of 1000A of thickness deposition and patterning vacuum deposition with this mask, and carried out heating baking processing for 10 minutes for organic [Pd] (ccp4230 Okuno Pharmaceuticals company make) at rotation spreading and 300 degrees C with the spinner on it. Moreover, the thickness of the thin film 3 for electron emission section formation which consists of a particle which consists of Pd as a main element formed in this way is 100A, and sheet resistance is 5x104. They were omega/**. In addition, as the particle film described here was mentioned above, it is the film with which two or more particles gathered, and not only the condition that the particle distributed separately but a particle puts mutually contiguity or the film in the condition (the shape of an island is also included) of having overlapped, as the fine structure, and the particle size means the path about the particle which can recognize particle shape in said condition.
(Process - g) The Cr film 141 and the thin film 3 for electron emission section formation after baking were etched by acid etchant, and the desired pattern was formed.
(Process - h) A pattern which applies a resist in addition to contact hole 152 part was formed, and the sequential deposition of Ti with a thickness of 50A and the Au with a thickness of 5000A was carried out with vacuum deposition. The contact hole 142 was embedded by removing an unnecessary part by lift off.
(Process - i) The carbon system thin film 6 was formed at the same process as an example 1.
[0069] The bottom wiring 82, the layer insulation layer 141, the upper wiring 83, the component electrodes 4 and 5, the thin film 3 for electron emission section formation, and the carbon system thin film 6 grade were formed on the insulating substrate 1 according to the above process.
[0070] In addition, drawing 8 is the electron emission component created at the almost same process as drawing 2 , and is formed in a wall surface perpendicular to electron emission section 2 substrate 1. Here, the insulating thin film 31 in drawing 8 is formed in order to offer the above-mentioned perpendicular wall surface.
[0071] Moreover, also in the electron emission component of drawing 7 in which the direct carbon system thin film 6 was formed on the substrate 1, it is fundamentally the same as that of drawing 14 and 15.
[0072] Next, the example which constituted the display using the electron source created as mentioned above is explained with reference to drawing 9 thru/or drawing 11 .
[0073] After fixing the substrate 1 which produced many flat-surface mold surface conduction electron emission components as mentioned above on the rear plate 91, To 5mm upper part of a substrate 1, a face plate 96 (a fluorescent screen 94 and the metal back 95 are formed and constituted by the inside of a glass substrate 93) is arranged through a housing 92. Frit glass was applied to the joint of a face plate 96, a housing 92, and the rear plate 91, and it sealed by calcinating 10 minutes or more at 400 degrees C thru/or 500 degrees C in atmospheric air or nitrogen-gas-atmosphere mind. moreover, since it is usually glass which is an insulator in a housing 92, it is charged also inside this housing -- making -- ** -- the carbon system thin film is formed like.
[0074] Moreover, frit glass also performed immobilization of the substrate 1 to the rear plate 91. In drawing 10 , 84 is 82 and an electron emission component and 83 are component wiring of the direction of X, and the direction of Y, respectively.
[0075] In the case of monochrome, it consisted only of the fluorescent substance, but in this example, the fluorescent substance adopted the stripe configuration, and the fluorescent screen 94 formed the black stripe previously, applied each color fluorescent substance to the gap section, and produced the fluorescent screen 94. The approach of applying a fluorescent substance to the glass substrate 93 using the ingredient which uses as a principal component the graphite used well usually used slurry method as an ingredient of a black stripe.
[0076] Moreover, the metal back 95 is usually formed in the inside side of a fluorescent screen 94. The metal back performed data smoothing (usually called filming) of the inside side front face of a fluorescent screen after fluorescent screen production, and it produced by carrying out vacuum deposition of the aluminum after that.
[0077] Since the conductivity of a fluorescent screen 94 is further raised to a face plate 96, a transparent electrode (un-illustrating) may be prepared in the external surface side of a fluorescent screen 84, but in this example, since conductivity sufficient in just the metal back was acquired, it omitted.
[0078] When performing the above-mentioned sealing, in the case of the color, sufficient alignment was performed in order to have to make each color fluorescent substance and an electron emission component correspond.
[0079] After exhausting the ambient atmosphere in the glassware completed as mentioned above with the vacuum pump through the exhaust pipe (not shown) and reaching sufficient degree of vacuum, the electrical potential difference

was impressed between the electrode 5 of the electron emission component 84, and 6 through the container outer edge child Dxo1 thru/or Doxm, Doy1, or Doyn, and the electron emission section 2 was created by carrying out foaming processing of the thin film 2 for electron emission section formation. The voltage waveform of foaming processing is the same as that of drawing 5 R>5b.

[0080] In this example, T1 was made into 1 ms, T2 was made into 10 mses, and it carried out under the vacuum ambient atmosphere of abbreviation 1x10-5Torr.

[0081] Thus, the created electron emission section 2 changed into the condition that the particle which uses a palladium element as a principal component was distributed, and the mean particle diameter of the particle was 30A.

[0082] Next, from the exhaust pipe of a panel, the acetone was introduced in the panel through the slow leak bulb, and 1.0x10-3Torr was maintained. By the same square wave as foaming, activation was performed wave height 14V with the degree of vacuum of degree of vacuum 2x10-5Torr, measuring the component current If and the emission current Ie. A line and the electron emission section 2 were formed for foaming and activation as mentioned above, and the electron emission component 84 was produced.

[0083] Next, to the degree of vacuum of 10-6Torr extent, it exhausted, and welded by heating a non-illustrated exhaust pipe with a gas burner, and the closure of an envelope was performed.

[0084] In order to maintain the degree of vacuum after the closure finally, getter processing was performed by the high-frequency-heating method.

[0085] In the image display device of this invention completed as mentioned above for each electron emission component Through the container outer edge child Dx1 Dxm and Dy1 thru/or Dyn by impressing a scan signal and a modulating signal from a signal generation means by which it does not illustrate, respectively Carried out electron emission, and impressed the high pressure of several kV or more to the metal back 09 or a transparent electrode (un-illustrating) through the secondary terminal Hv, accelerated the electron beam, it was made to collide with a fluorescent screen 08, and the image was displayed by making light excite and emit.

[0086] Also in this case, the stable image was displayed and destruction by the flaw and discharge of the deviation of an electron beam etc. was not seen [near the housing].

[0087] In addition, although the electron source which wired the ladder mold in the electron emission component was shown in drawing 16, the same is said of the manufacture approach of this image display device.

[0088] Drawing 16 is the mimetic diagram showing an example of the electron source of ladder mold arrangement. In drawing 16 , the electron emission component 84 is formed on the electron source substrate 1. The common wiring 12412 (Dx1-Dx10) is for connecting the electron emission component 84. Two or more child emission components 84 are allotted to juxtaposition in the direction of X on the substrate 1 (this is called a component line). Two or more these component lines are arranged, and constitute the electron source. Each component line can be made to drive independently by impressing driver voltage between common wiring of each component line. namely, -- the component line which does not emit an electron beam for the electrical potential difference more than an electron emission threshold to a component line to make it emit an electron beam -- the electrical-potential-difference impression below an electron emission threshold -- it carries out. The common wiring Dx2-Dx9 of each component spacing can also consider Dx2 and Dx3 as the same wiring.

[0089] Drawing 17 is the perspective view showing an example of the panel structure in image formation equipment equipped with the electron source of ladder mold arrangement. The hole 133 for an electron to pass is established in the grid electrode 132. Moreover, D1, D2, --Dm are container outer edge children. G1, G2, --Gn are the container outer edge children connected to the grid electrode 132. In the electron source substrate 1, common wiring of each component spacing is considered as the same wiring. In drawing 17 , the grid electrode 132 is formed between the substrate 1 and the face plate 96. The grid electrode 132 is for modulating the electron beam emitted from the surface conduction mold emission component, and in order to make the electrode of the shape of a stripe established by intersecting perpendicularly with the component line of ladder mold arrangement pass an electron beam, corresponding to each component, the hole 133 circular one piece at a time is formed. The configuration or installation location of a grid are not limited to what was shown in drawing 17 . For example, much passage openings can also be prepared in the shape of a mesh as a hole, and a grid can also be prepared a perimeter and near the surface conduction mold emission component.

[0090] The container outer edge children D1 and D2, --Dm and the grid container outer edge children G1 and G2, --Gn are electrically connected with the non-illustrated control circuit.

[0091] With the image formation equipment of this example, the modulating signal for the image of one line is impressed to a grid electrode train at coincidence synchronizing with carrying out the sequential drive (scan) of the one every train of the component lines. Thereby, the exposure to the fluorescent substance of each electron beam can be

controlled, and it can display the image of one line at a time.
[0092] Moreover, the carbon system thin film used for this invention is suitable to also cover not only an electron emission component but other components of the image formation equipment which used this.
[0093] Drawing 18 forms a vacuum base material in the image formation equipment shown in drawing 10 further. This vacuum base material 200 is formed in order to maintain a face play and the smoothness system of 96 and to maintain the reinforcement of the image display panel 111 whole. That is, if image display is performed being accompanied by electron emission, the electron will cause the charge up in the vacuum base material 200 above-mentioned front face. Also in order to prevent this charge up, the carbon system thin film is useful.
(Example 4) Next, the example of a configuration of the drive circuit for performing the television display based on the TV signal of NTSC system is explained to the display panel constituted using the electron source of passive-matrix arrangement using drawing 19 . In drawing 19 , since the image display panel 111 is driven, a scanning circuit 112, a control circuit 113, a shift register 114, the Rhine memory 115, the synchronizing signal separation circuit 116, the modulating-signal generator 117, and direct current voltage supplies Vx and Va are formed.
[0094] The display panel 111 is connected with the external electrical circuit through a terminal Dx1 thru/or Dxm, a terminal Dy1 or Dyn, and a secondary terminal Hv. The scan signal for carrying out the party [every] (n elements) sequential drive of the electron emission elements by which matrix wiring was carried out is impressed at a terminal Dx1 thru/or Dxm to the electron source established in the display panel, i.e., the letter of a matrix of a m line n train.
[0095] The modulating signal for controlling the output electron beam of each component a party's electron emission component chosen by said scan signal is impressed to a terminal Dy1 thru/or Dyn. Although the direct current voltage of 10kV is supplied to a secondary terminal Hv from direct current voltage supply Va, this is the acceleration voltage for giving sufficient energy exciting a fluorescent substance to the electron beam emitted from an electron emission component.
[0096] A scanning circuit 112 is explained. Inside, this circuit is the thing equipped with m switching elements (S1 thru/or Sm show typically among drawing), and is located. Each switching element chooses the output voltage of direct current voltage supply Vx, or either of 0V (grand level), and is electrically connected with the terminal Dx1 of a display panel 101 thru/or Dxm. Each switching element of S1 thru/or Sm can operate based on the control signal Tscan which a control circuit 103 outputs, and can be constituted by combining switching like FET for example.
[0097] In this example, direct current voltage supply Vx are set up so that a fixed electrical potential difference which the driver voltage impressed to the component which is not scanned based on the property (electron emission threshold electrical potential difference) of an electron emission component turns into below an electron emission threshold electrical potential difference may be outputted.
[0098] A control circuit 113 has the function to adjust actuation of each part so that a suitable display may be performed based on the picture signal inputted from the exterior. A control circuit 113 generates each control signal of Tscan, Tsft, and Tmry to each part based on the synchronizing signal Tsync sent from the synchronizing signal separation circuit 116.
[0099] The synchronizing signal separation circuit 116 is a circuit for separating a synchronizing signal component and a luminance-signal component from the TV signal of the NTSC system inputted from the outside, and can be constituted using a general frequency-separation (filter) circuit etc. Although the separation **** synchronizing signal consisted of the Vertical Synchronizing signal and the Horizontal Synchronizing signal by the synchronizing signal separation circuit 116, it illustrated as an expedient Tsync signal of explanation here. The luminance-signal component of the image separated from said TV signal was expressed as the DATA signal for convenience. Said DATA signal is inputted into a shift register 114.
[0100] It operates based on the control signal Tsft which a shift register 114 is for carrying out serial/parallel conversion of said DATA signal inputted serially for every line of an image, and is sent from said control circuit 113 (that is, it can also be said that a control signal Tsft is the shift clock of a shift register 104.). The data for the image of one line by which serial/parallel conversion was carried out (equivalent to the drive data for an electron emission component N component) are outputted from said shift register 104 as a parallel signal of Id1 thru/or N individual of Idn.
[0101] The Rhine memory 115 is storage for between need time amount to memorize the data for the image of one line, and memorizes the contents of Id1 thru/or Idn suitably according to the control signal Tmry sent from a control circuit 113. The memorized contents are outputted as I'd1 thru/or I'dn, and are inputted into the modulating-signal generator 117.
[0102] The modulating-signal generator 107 is a source of a signal for carrying out the drive modulation of each of an electron emission component appropriately according to each of image data I'd1 thru/or I'dn, and the output signal is

impressed to the electron emission component in a display panel 111 through a terminal Dy1 thru/or Dyn.
[0103] As mentioned above, the electron emission component which can apply this invention has the following basic properties to the emission current Ie. That is, there is a clear threshold electrical potential difference Vth in electron emission, and only when the electrical potential difference more than Vth is impressed, electron emission arises. To the electrical potential difference more than an electron emission threshold, the emission current also changes according to change of the applied voltage to a component. When impressing a pulse-like electrical potential difference to this component, for example, even if it impresses the electrical potential difference below an electron emission threshold, electron emission is not produced from this, but an electron beam is outputted when impressing the electrical potential difference more than an electron emission threshold. It is possible in that case to control the reinforcement of an output electron beam by changing the peak value Vm of a pulse. Moreover, it is possible to control the total amount of the charge of the electron beam outputted by changing the width of face Pw of a pulse.
[0104] Therefore, according to an input signal, an electrical-potential-difference modulation technique, pulse width modulation, etc. are employable as a method which modulates an electron emission component. It faces carrying out an electrical-potential-difference modulation technique, and as a modulating-signal generator 117, the electrical-potential-difference pulse of fixed die length is generated, and the circuit of an electrical-potential-difference modulation technique which modulates the peak value of a pulse suitably according to the data inputted can be used.
[0105] It faces carrying out pulse width modulation and the circuit of pulse width modulation which generates the electrical-potential-difference pulse of fixed peak value as a modulating-signal generator 107, and modulates the width of face of an electrical-potential-difference pulse suitably according to the data inputted can be used.
[0106] The thing of an analog signal type can also be used for a shift register 114 or the Rhine memory 115 also for the thing of a digital signal type. It is because serial/parallel conversion and storage of a picture signal should just be performed at the rate of predetermined.
[0107] What is necessary is just to form an A/D converter in the output section of 116 at this, although it is necessary to digital-signal-ize the output signal DATA of the synchronizing signal separation circuit 116 to use a digital signal type. The circuit where the output signal of the Rhine memory 115 is used for the modulating-signal generator 117 by the digital signal or the analog signal in relation to this becomes a different thing a little. That is, in the case of the electrical-potential-difference modulation technique using a digital signal, it responds to the modulating-signal generator 117 at the need for example, using a D/A conversion circuit, and is ****** about an amplifying circuit etc. In the case of pulse width modulation, the circuit which combined the comparator (comparator) which compares with the output value of said memory the output value of the counter (counter) which carries out counting of the wave number which a high-speed oscillator and an oscillator output, and a counter is used for the modulating-signal generator 117. The amplifier for amplifying the voltage of the modulating signal which a comparator outputs and by which Pulse Density Modulation was carried out even to the driver voltage of an electron emission component if needed can also be added.
[0108] In the case of the electrical-potential-difference modulation technique using an analog signal, the amplifying circuit which used the operational amplifier etc. can be adopted as the modulating-signal generator 117, and a level shift circuit etc. can also be added to it if needed. In the case of pulse width modulation, for example, a voltage-controlled oscillator circuit (VCO) can be adopted, and the amplifier for ******(ing) to the driver voltage of an electron emission component if needed can also be added to it.
[0109] In the image image formation equipment (display) of such this invention, electron emission arises by impressing a signal level and a scan electrical potential difference to each electron emission component through the container outer edge child D1 Dm and G1 thru/or Gn. High pressure is impressed to the metal back 85 or a transparent electrode (un-illustrating) through a secondary terminal Hv, and an electron beam is accelerated. The accelerated electron collides with a fluorescent screen 94, luminescence produces it, and an image is formed.
[0110] The configuration of the image formation equipment described here is an example of the image formation equipment which can apply this invention, and various deformation is possible for it based on the technical thought of this invention. Although NTSC system was held about the input signal, an input signal is not restricted to this and high definition TV methods and ATV methods including TV signal which consists of much scanning lines, for example, MUSE, can also be used for it rather than this besides being PAL, an SECAM system, etc.
[0111] The image formation equipment of this invention can be used also as image formation equipment as an optical printer constituted using the photosensitive drum besides image formation equipments (indicating equipment), such as image formation equipment (indicating equipment) of television broadcasting, a video conference system, and a computer, etc.
[0112] Next, drawing 20 is drawing to show an example of the display constituted so that the image information with

which the display panel which used the surface conduction mold emission component of said explanation as a source of an electron beam is provided from the various sources of image information including television broadcasting could be displayed. 1800 in drawing -- a display panel and 1801 -- the drive circuit of a display panel, and 1802 -- a display-panel controller and 1803 -- a multiplexer and 1804 -- a decoder and 1805 -- as for an image input interface circuitry, and 1812 and 1813, for an image generation circuit, 1808, and 1809 and 1810, an image memory interface circuitry and 1811 are [an input/output interface circuit and 1806 / CPU and 1807 / TV signal receive circuit and 1814] the input sections. (When receiving the signal which contains both image information and speech information like a television signal , in addition , naturally , this indicating equipment omits explanation about a circuit , a loudspeaker , etc. about reception , separation , regeneration , storage , etc. of the speech information which is not directly related to the description of this invention , although it is ****** about a display , simultaneously the voice of an image .) in accordance with the flow of a picture signal , the function of each part explains hereafter .

[0113] First, the TV signal receive circuit 1813 is a circuit for receiving TV picture signal transmitted using radio-transmission systems, such as an electric wave and space optical communication. Especially the method of TV signal to receive may not be restricted and many methods, such as NTSC system, a PAL system, and an SECAM system, are sufficient as it. Moreover, TV signal (for example, the so-called high definition V including MUSE) which consists of these from much scanning lines further is a suitable source of a signal for raw or that about the advantage of said display panel suitable for large-area-izing or large pixel number-ization. TV signal received by the TV signal receive circuit 1813 is outputted to a decoder 1804.

[0114] Moreover, the TV signal receive circuit 1812 is a circuit for receiving TV picture signal transmitted using cable-transmission systems, such as a coaxial cable and an optical fiber. Like said TV signal receive circuit 1813, especially the method of TV signal to receive is not restricted and TV signal received in this circuit is also outputted to a decoder 1804.

[0115] Moreover, the picture signal which the image input interface circuitry 1811 is a circuit for incorporating the picture signal supplied from picture input devices, such as a TV camera and an image reading scanner, and was incorporated is outputted to a decoder 1804.

[0116] Moreover, the picture signal which the image memory interface circuitry 1810 is a circuit for incorporating the picture signal memorized by the video tape recorder (it omits Following VTR), and was incorporated is outputted to a decoder 1804.

[0117] Moreover, the picture signal which the image memory interface circuitry 1809 is a circuit for incorporating the picture signal memorized by the videodisk, and was incorporated is outputted to a decoder 1804.

[0118] Moreover, the static-image data which are a circuit for incorporating a picture signal and were incorporated are inputted into a decoder 1804 from the equipment with which the image memory interface circuitry 1808 has memorized static-image data like the so-called still picture disk.

[0119] Moreover, the input/output interface circuit 1805 is a circuit for connecting this display and output units, such as an external computer, a computer network, or a printer. Not to mention performing I/O of image data, or an alphabetic character and graphic form information, it is also possible to perform a control signal, I/O of numeric data, etc. between CPUs1806 and the exteriors with which this indicating equipment is equipped depending on the case.

[0120] moreover, the image data, and an alphabetic character and graphic form information that the image generation circuit 1807 is inputted from the outside through said input/output interface circuit 1805 -- or it is a circuit for generating the image data for a display based on the image data, and the alphabetic character and graphic form information which are outputted from CPU1806. The circuit required for generation including images, such as rewritable memory for accumulating image data, and an alphabetic character and graphic form information, read-only memory the image pattern corresponding to a character code is remembered to be, and a processor for performing an image processing, is included in the interior of this circuit.

[0121] Although the image data for a display generated by this circuit is outputted to a decoder 1804, it is also possible to output to an external computer network and an external printer through said input/output interface circuit 1805 depending on the case.

[0122] Moreover, CPU1806 does the activity which relates mainly to the motion control of this display, generation of a display image, selection, or edit.

[0123] For example, a control signal is outputted to a multiplexer 1803, and the picture signal displayed on a display panel is chosen suitably, or is combined. moreover, the picture signal displayed in that case -- responding -- the display-panel controller 1802 -- receiving -- a control signal -- generating -- a screen-display frequency, a scan method (for example, is it an interlace or non-interlaced?), and a stroke -- actuation of displays, such as the number of the scanning lines of a field, is controlled suitably.

[0124] Moreover, the direct output of image data, or an alphabetic character and graphic form information is carried out, or an external computer and memory are accessed through said input/output interface circuit 1805 to said image generation circuit 1807, and image data, and an alphabetic character and graphic form information are inputted. In addition, of course, CPU1806 may also start the activity of the purposes other than this. For example, it may be directly concerned with the function which generates information or is processed like a personal computer or a word processor. Or as mentioned above, it may connect with an external computer network through the input/output interface circuit 1805, for example, the activity of numerical calculation etc. may be done in cooperation with an external instrument.
[0125] Moreover, the input section 1814 is for a user to input an instruction, a program or data, etc. into said CPU1806, for example, can use various input devices, such as a keyboard, a joy stick besides a mouse, a bar code reader, and a voice recognition unit.
[0126] Moreover, a decoder 1804 is a circuit for carrying out inverse transformation of the various picture signals inputted from said 1807 thru/or 1813 to a three-primary-colors signal or a luminance signal and an I signal, and a Q signal. In addition, all over this drawing, as a dotted line shows, as for a decoder 1804, it is desirable to equip the interior with an image memory. This is for treating TV signals which face carrying out inverse transformation and need an image memory including MUSE. Moreover, it is because the advantage that image processings and edits including infanticide of an image, interpolation, expansion, contraction, and composition can be easily performed now in cooperation with said image generation circuit 1807 and CPU1806 is born or the display of a still picture becomes easy by having an image memory.
[0127] Moreover, a multiplexer 1803 chooses a display image suitably based on the control signal inputted from said CPU1806. Namely, a multiplexer 1803 chooses [from] a desired picture signal among the picture signals which are inputted from a decoder 1804 and by which inverse transformation was carried out, and outputs it to the drive circuit 1801. In that case, it is also possible by changing and choosing a picture signal within 1 screen-display time amount to display the image which divides one screen into two or more fields, and changes with fields like the so-called multi-screen television.
[0128] Moreover, the display-panel controller 1802 is a circuit for controlling actuation of the drive circuit 1801 based on the control signal inputted from said CPU1806.
[0129] First, the signal for controlling the operating sequence of the power source for a drive of a display panel (not shown) is outputted to the drive circuit 1801 as a thing concerning fundamental actuation of a display panel. Moreover, the signal for controlling for example, a screen-display frequency and a scan method (for example, is it an interlace or non-interlaced?) is outputted to the drive circuit 1801 as a thing concerning the drive approach of a display panel.
[0130] Moreover, the control signal which starts adjustment of the brightness and contrast of a display image, a color tone, or the image quality of sharpness depending on the case may be outputted to the drive circuit 1801.
[0131] Moreover, the drive circuit 1801 is a circuit for generating the driving signal impressed to a display panel 1800, and operates based on the picture signal inputted from said multiplexer 1803, and the control signal inputted from said display-panel controller 1802.
[0132] Although the function of each part was explained above, it is possible to display the image information inputted from the various sources of image information in this indicating equipment by the configuration illustrated to drawing 1 on a display panel 1800. That is, after inverse transformation of various kinds of picture signals including television broadcasting is carried out in a decoder 1804, they are suitably chosen in a multiplexer 1803 and are inputted into the drive circuit 1801. On the other hand, a display controller 1802 generates the control signal for controlling actuation of the drive circuit 1801 according to the picture signal to display. The drive circuit 1801 impresses a driving signal to a display panel 1800 based on the above-mentioned picture signal and a control signal. Thereby, an image is displayed in a display panel 1800. These the actuation of a series of is controlled by CPU1806 in generalization.
[0133] Moreover, in this indicating equipment, it is possible in it not only displaying the image memory built in said decoder 1804, and the thing chosen from the image generation circuit 1807 and information, but carrying out edits including an image, such as composition including image processings, such as expansion, contraction, rotation, migration, edge enhancement, infanticide, interpolation, color conversion, and aspect ratio conversion of an image, elimination, connection, exchange, and fitting, as opposed to the image information to display. Moreover, although especially explanation of this example did not describe, the specialized circuit for performing processing and edit also about speech information may be prepared like the above-mentioned image processing or image edit.
[0134] Therefore, this indicating equipment can have functions, such as terminal equipments for office work including the image edit device treating the display device of television broadcasting, the terminal equipment of a television conference, a static image, and a dynamic image, the terminal equipment of a computer, and a word processor, and a game machine, by one set, and its application range is very wide as industrial use or a noncommercial use. In addition,

it cannot be overemphasized that it is not what does not pass this drawing for an example of the configuration of the display using the display panel which makes a surface conduction mold emission component the source of an electron beam to have been shown, but is limited only to this. For example, even if it excludes the circuit concerning the function which does not have the purpose-of-use top need among the components of drawing 1 , it does not interfere. Moreover, contrary to this, a component may be further added depending on the purpose of use. For example, when applying this indicating equipment as a TV phone machine, it is suitable to add the transceiver circuit containing a television camera, a voice microphone, a lighting machine, and a modem etc. to a component.

[0135] In this indicating equipment, since the formation of a thin form of the display panel which especially makes a surface conduction mold emission component the source of an electron beam is easy, depth of an indicating equipment can be made small.

[0136] Big-screen-izing is easy for the display panel which makes a surface conduction mold emission component the source of an electron beam in addition to it, and since brightness is highly excellent also in an angle-of-visibility property, this display can display the image which was rich in overflow force with sufficient visibility on presence.

[0137]

[Effect of the Invention] Degradation of the component according to this invention, the electron emission characteristic of an electron emission component becomes very stable like, and according to discharge explained above was also able to be prevented.

[0138] Furthermore, it sets to the electron source which emits an electron according to an input signal. By constituting the electron source which has arranged two or more above-mentioned electron emission components on a base The line of the electron emission component which connected the both ends of each component to wiring Moreover, two or more rice cake, the arranging method for having the modulation means further, Electrically the electron emission component of each other which connected the component electrode of the pair of this electron emission component to the direction wiring of X of m and the direction wiring of Y of n which were insulated to a base by or the thing to consider as the electron source considered as the arranged arrangement Each electron emission component can manufacture now with the sufficient yield stably.

[0139] Moreover, in image formation equipment, it was equipment which forms an image based on an input signal, and at least, since it was image formation equipment characterized by consisting of an image formation member and said electron source, it realized in the image formation equipment which the stability of the electron emission characteristic and improvement in a life are made, for example, uses a fluorescent substance as an image formation member, high-definition image formation equipment, for example, color flat television.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

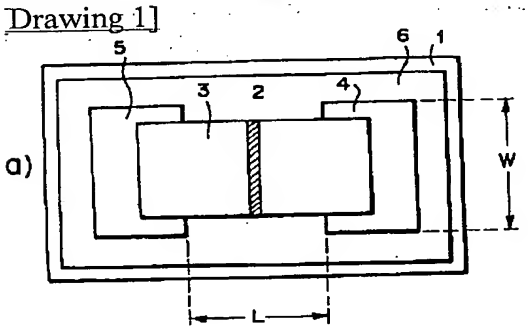
[Brief Description of the Drawings]
[Drawing 1] The basic block diagram of the flat-surface mold surface conduction electron emission component concerning this invention.
[Drawing 2] The production process Fig. of the surface conduction mold electron emission component concerning this invention.
[Drawing 3] The conceptual diagram of the weighting network of electrification concerning this invention.
[Drawing 4] Drawing showing probe potential.
[Drawing 5] The foaming electrical-potential-difference wave form chart concerning this invention.
[Drawing 6] Drawing showing the measurement evaluation equipment of the surface conduction mold electron emission component concerning this invention.
[Drawing 7] Drawing showing the surface conduction mold electron emission component concerning this invention.
[Drawing 8] Drawing showing the surface conduction mold electron emission component of the vertical type concerning this invention.
[Drawing 9] The electron source block diagram of this invention.
[Drawing 10] The perspective view of the image formation equipment of this invention.
[Drawing 11] The explanatory view of a fluorescent screen.
[Drawing 12] The top view of a passive-matrix mold electron source.
[Drawing 13] The A-A' sectional view of a passive-matrix mold electron source.
[Drawing 14] The production process ((a)-(d)) Fig. of a passive-matrix mold electron source.
[Drawing 15] The production process ((e)-(i)) Fig. of a passive-matrix mold electron source.
[Drawing 16] The top view of a ladder mold electron source.
[Drawing 17] The perspective view of the image formation equipment using a ladder mold electron source.
[Drawing 18] The perspective view of the vacuum base material in the image formation equipment using a passive-matrix mold electron source.
[Drawing 19] The block diagram of the drive circuit of the display panel using a passive-matrix mold electron source.
[Drawing 20] The block diagram of the image display device of this invention.
[Drawing 21] The top view of the conventional surface conduction mold electron emission component.
[Description of Notations]
1 Insulating Substrate
2 Electron Emission Section
3 Conductive Thin Film
4 Five Component electrode
6 Carbon System Thin Film
50 Anode Electrode
65 Measurement Evaluation Equipment
66 Vacuum Pump
70 High Voltage Power Supply
82 Bottom Wiring
83 Upper Wiring
93 Glass Substrate
94 Fluorescent Screen
95 Metal Back

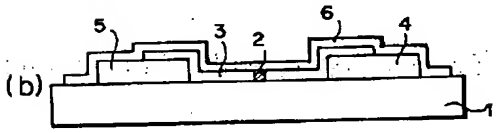
)6 Face Plate
.31 First Publication Insulator Layer
132 Grid Electrode
133 Hole
151 Contact Hole
200 Vacuum Base Material

Translation done.]

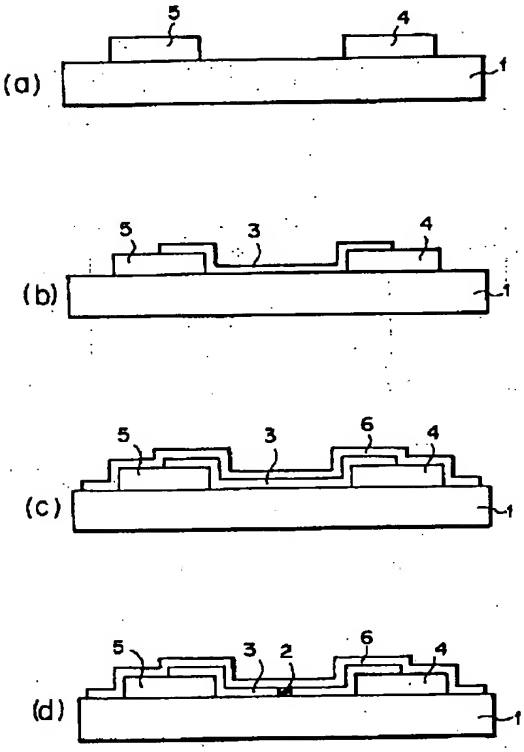
DRAWINGS

[Drawing 1]

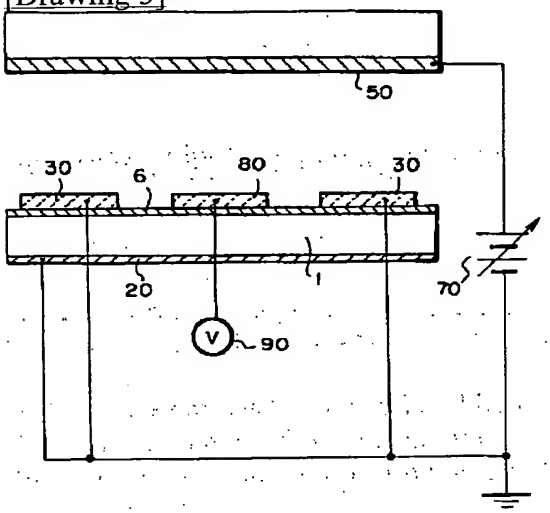




[Drawing 2]



[Drawing 3]



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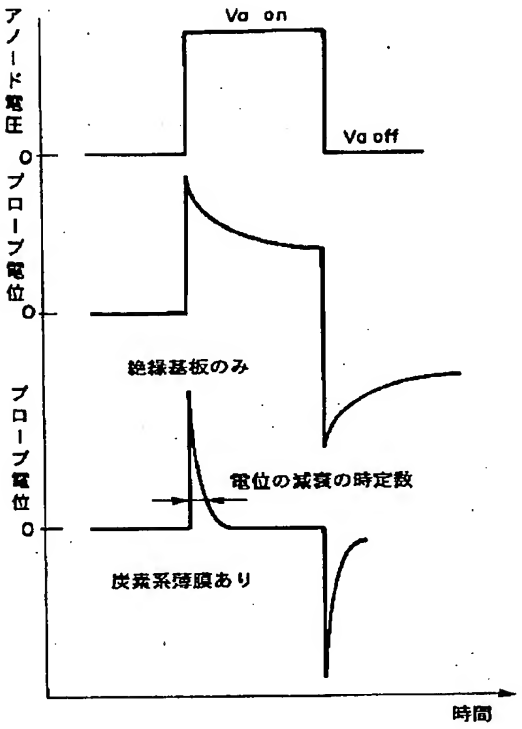
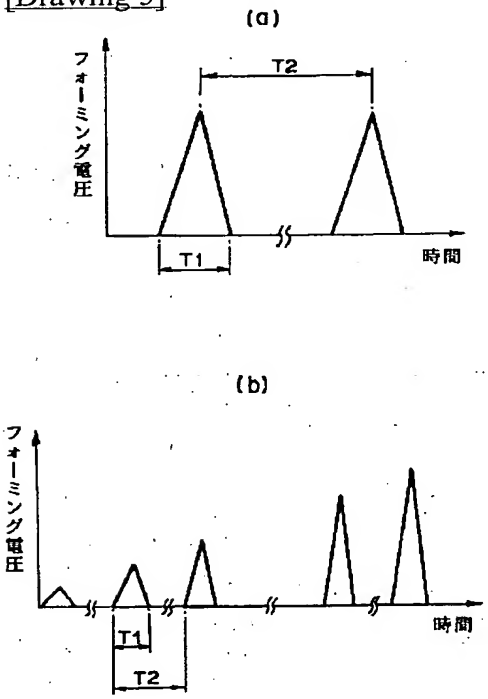


[Drawing 5]



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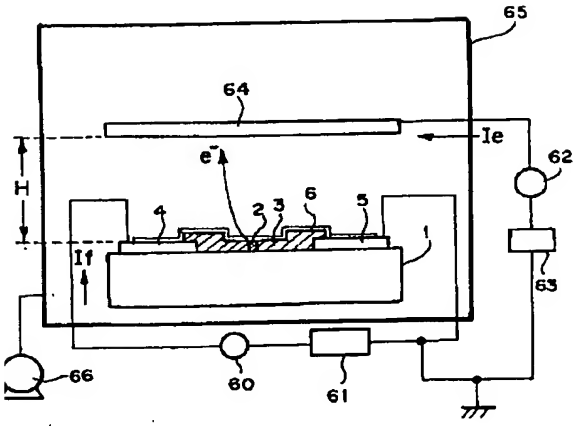
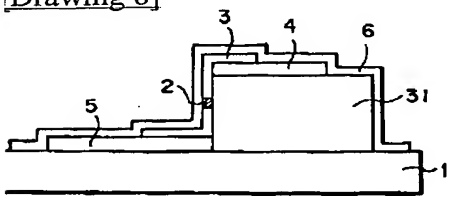
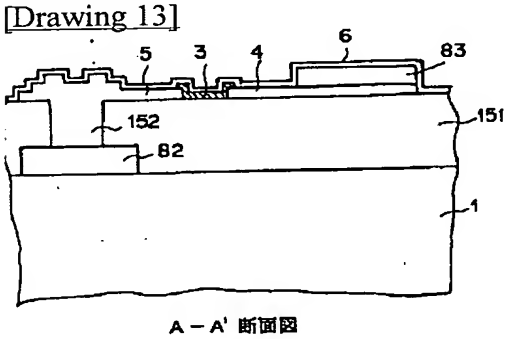


[Drawing 8]

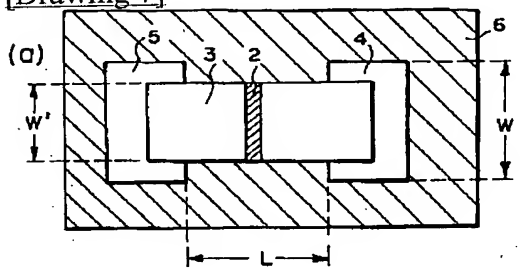


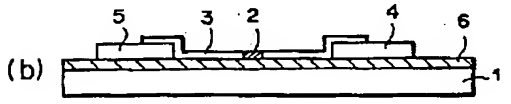
[Drawing 13]



A－A' 断面図

[Drawing 7]





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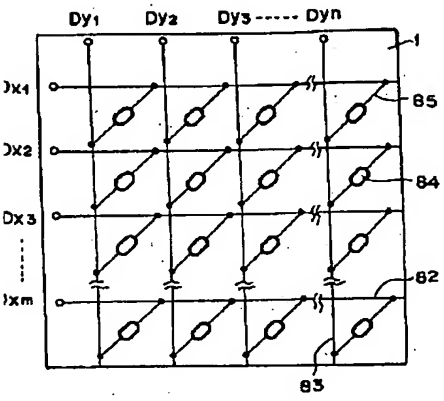
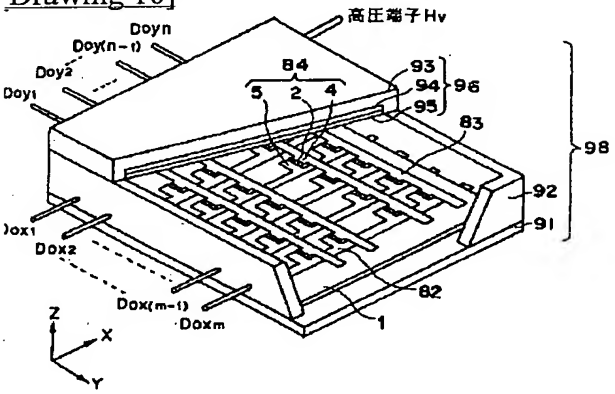
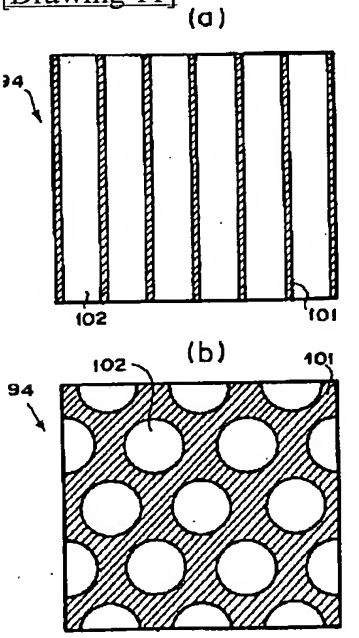


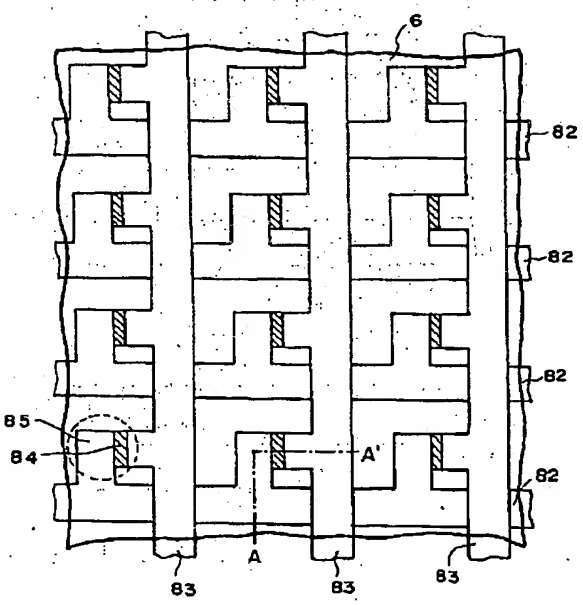
Drawing 10]



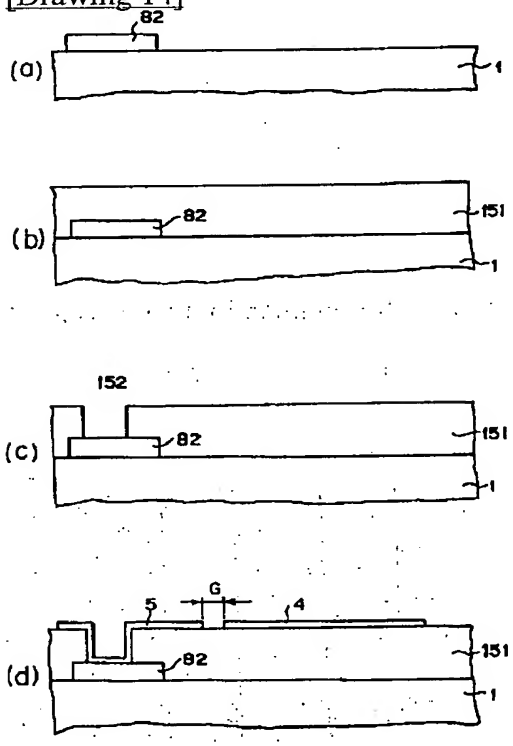
[Drawing 11]



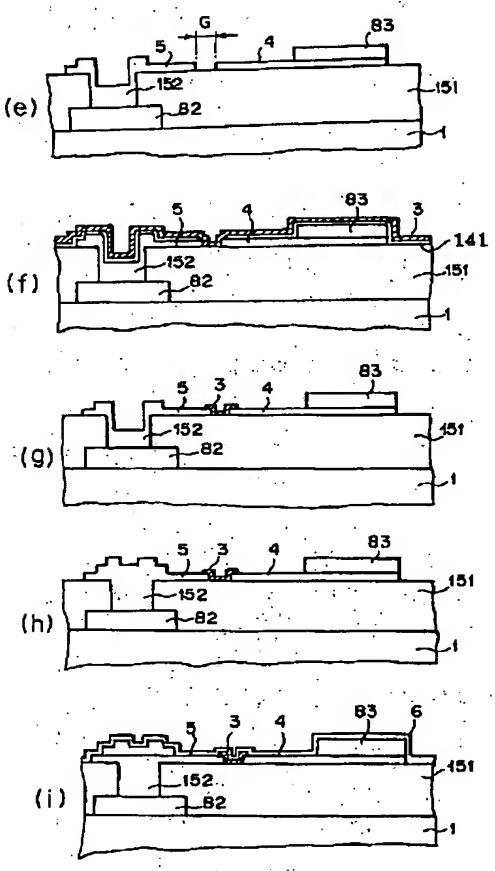
[Drawing 12]



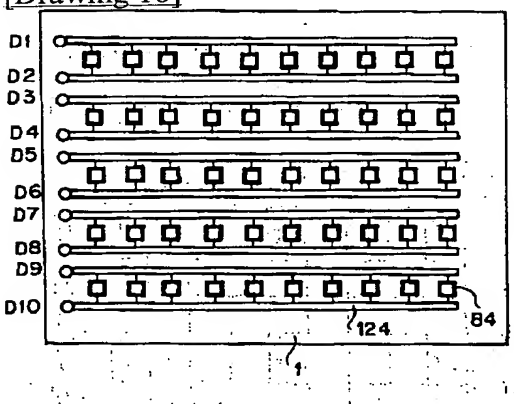
[Drawing 14]



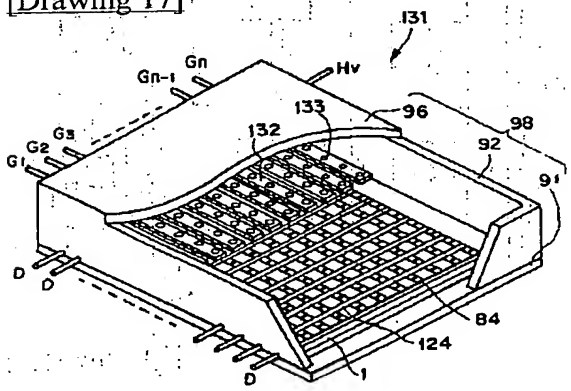
[Drawing 15]



[Drawing 16]



[Drawing 17]



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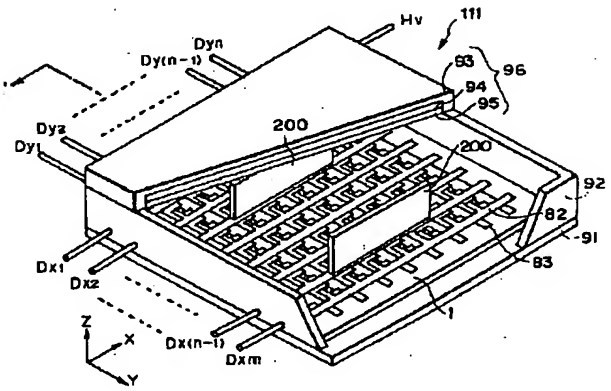
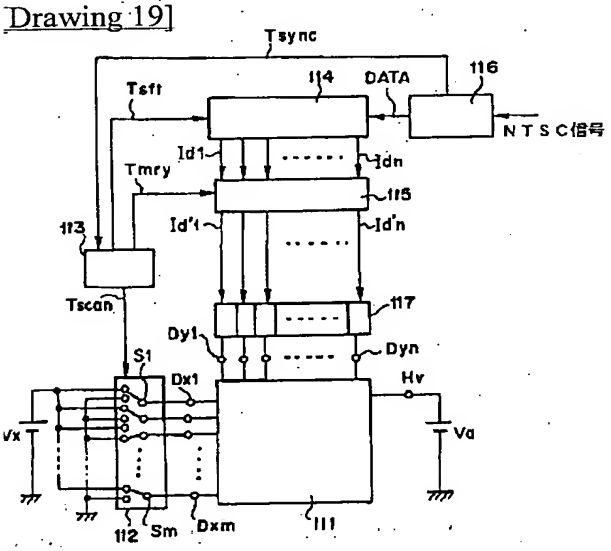
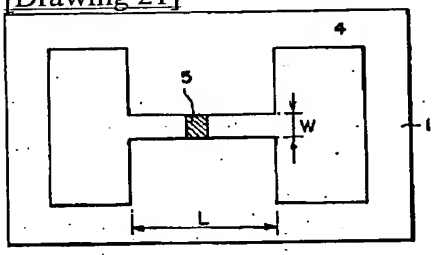


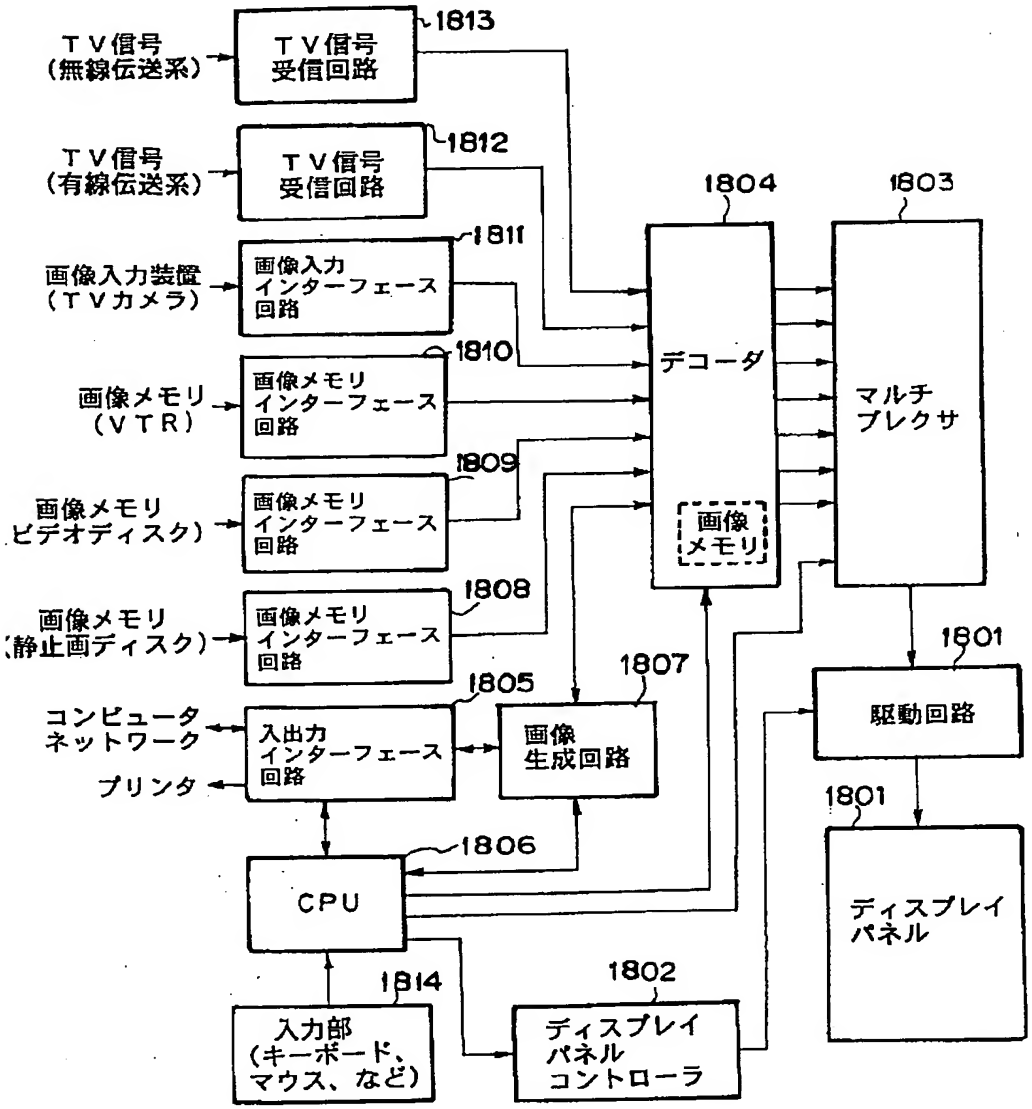
Drawing 19]



[Drawing 21]



[Drawing 20]



[Translation done.]